Ohio Agricultural Experiment Station.

BULLETIN 47.

WOOSTER, O., DECEMBER, 1892.

....AND....

ELEVENTH ANNUAL REPORT

FOR 1892.

The Bulletin of this Station is sent free to all residents of the state who request it. Persons who receive duplicate copies of the Bulletin, or who do not care to receive any, are requested to notify the Station, as the edition is not sufficient to supply the urgent demand for it. All correspondence should be addressed to EXPERIMENT STATION, *Wooster, Ohio*

NORWALK, OHIO:
THE LANING PTG. CO., STATE PRINTERS.
1893

Digitized by the Internet Archive
in 2017 with funding from
This project is made possible by a grant from the Institute of Museum and Library Services as administered by the Pennsylvania Department of Education through the Office of Commonwealth Libraries

https://archive.org/details/eleventhannualre00ohio

ELEVENTH ANNUAL REPORT

OF THE

OHIO AGRICULTURAL

EXPERIMENT STATION,

FOR 1892.

PRINTED BY ORDER OF THE STATE LEGISLATURE.

TABLE OF CONTENTS.

Board of Control and Officers.

Announcement.

Report of the Secretary of the Board of Control.

Report of the Treasurer.

Report of the Director.

Report of the Agriculturist.

Report of the Horticulturist.

Report of the Entomologist.

Report of the Botanist.

Report of the Chemist.

Report of the Meteorologist.

Appendix—The Bulletin for 1892.

. . . ORGANIZATION OF THE . . .

OHIO AGRICULTURAL EXPERIMENT STATION.

BOARD OF CONTROL.

SETH H. ELLIS,	Springboro.
HON. JOSEPH H. BRIGHAM,	Delta.
R. H. WARDER,	North Bend.
THE GOVERNOR OF THE STATE,	*Ex-Officio.*
THE DIRECTOR OF THE STATION,	

OFFICERS OF THE BOARD.

SETH H. ELLIS,	President.
PROF. WILLIAM R. LAZENBY,	Secretary.
BERTHA E. WILDMAN,	Treasurer.

STATION STAFF.

CHARLES E. THORNE,	Director.
WILLIAM J. GREEN,	Horticulturist and Vice-Director.
J. FREMONT HICKMAN, M. A. S.,	Agriculturist.
FRANCIS M. WEBSTER,	Entomologist.
BERTHA E. WILDMAN,	Bursar.
EDWIN C. GREEN,	Assistant Horticulturist.
F. J. FALKENBACH,	Chemist and Meteorologist.

ANNOUNCEMENT.

The Ohio Agricultural Experiment Station is organized under an act of the General Assembly of Ohio, passed April 17th, 1882, and supplemented by an act of Congress, approved March 2, 1887.

The Station is prepared to test new varieties of grains, fruits and garden vegetables; to examine seeds that are suspected of being unsound or adulterated; to identify and name grasses, weeds and other plants; to identify insects and suggest measures for the control of such as are injurious, and to give advice concerning the prevention of the fungoid diseases which affect vegetation.

The Station is not prepared to furnish analyses of chemical or commercial fertilizers, as in Ohio that work is performed under direction of the Secretary of the State Board of Agriculture at Columbus; but the Station will at all times respond to requests for advice concerning the use of such fertilizers.

The Station is not prepared to examine foods and dairy products suspected of adulteration, as that work is provided for in the Ohio Dairy and Food Commission, whose headquarters are at Columbus.

The Station is not at present prepared to offer advice or treatment for contagious animal diseases, but would refer all seeking such assistance to the Ohio Live Stock Commission, at Columbus.

Any citizen of Ohio has the right to apply to the Station for any information it can render, and all such applications will receive prompt attention.

Visitors to the Station are always welcome.

Address all communciations to

EXPERIMENT STATION, *Wooster, Ohio.*

Eleventh Annual Report.

REPORT OF THE BOARD OF CONTROL.

To Hon. WILLIAM MCKINLEY, JR., *Governor of Ohio:*

SIR:—The Board of Control of the Ohio Agricultural Experiment Station herewith submits the eleventh annual report of the Station for the year 1892.

REMOVAL OF THE STATION.

In the annual report for 1891 was given a copy of the law authorizing the removal of the station, together with an account of action under this law, by which a site in Wayne county, near the city of Wooster, had been chosen as the future home of the Station.

A portion of the land purchased for the use of the Station was occupied on the first of April, and the remainder at different dates, later in the season, the final removal of the Station from Columbus taking place in September.

LITIGATION AFFECTING THE STATION.

The bonds of Wayne county for $85,000, issued under authority of the law above mentioned, for the purchase and improvement of land within the county for the use of the Station, were sold at a premium. This premium the county commissioners offered for deposit in the county treasury, but the treasurer refused to accept it, holding the law authorizing the issue of the bonds to be unconstitutional. The commissioners instituted mandamus proceedings, and the treasurer brought action to enjoin the commissioners from levying the tax provided for the payment of the bonds, to which the commissioners replied by demurrer.

The common pleas and circuit courts both sustained the commissioners in both suits; but the supreme court, in a decision promulgated in November, reversed the decisions of the lower courts, dismissing the mandamus suit and overruling the demurrer in the injunction suit and remanding this case to the lower court "for further proceedings according to law." From this decision Judge Minshall dissented. Following is the syllabus of the decision:

"3,084. R. B. Wasson et al. *vs.* Board of Commissioners of Wayne county et al. Error to the Circuit Court of Wayne county.

Spear, C. J.: 1. A law, which provides for the location and construction of an institution to be controlled wholly by a Board appointed by the Governor, and for the furnishing of information to the people of the State at large, as to the work of such institution exclusively by the Board and State officers at the expense of the State, is a law in general and not of local character, notwithstanding incidental benefits may accrue to property near such institution by reason of its location, and money raised by taxation for the purchase of a site and the construction of buildings is general revenue for the State.

2. Under section 2 of article 12 of the constitution, which provides that "laws shall be passed taxing by a uniform rule all moneys, credits, and also real and personal property according to its true value in money," all taxes for general revenue for the State must be levied by a uniform rule upon all the taxable property within the State.

3. The act of April 23, 1891, which attempts to authorize any county of the State to raise money to secure the location therein of the Ohio Agricultural Experiment Station by a tax upon all the taxable property within such county is in contravention of section 2, of article 12 of the constitution, and is, therefore, void.

Judgments reversed."

The question now before the courts is whether the collection of this tax can be prevented, since no legal objection was raised until after the bonds had been sold and proceeds used as required by law and thereby distributed into the various channels of business.

THE STATION'S LOCATION.

The Board of Control has every reason to believe that the obstructive litigation above referred to is not indorsed by even a respectable minority of the citizens of Wayne county, but that the people of the county as a whole desire to have the Station located in their midst, and stand ready to redeem their pledge, made at the polls in October, 1891. In the decisions of the Supreme courts of Ohio and other states ample justification is found for the expectation that, notwithstanding the fact that the law in question has been declared unconstitutional, yet the proceedings which were conducted under it in good faith and without legal objection must be ratified, and therefore that the tax will be collected and the bonds redeemed as provided by the law. Should this expectation be justified by subsequent events the Station will be as much bound to abide in Wayne county as though the constitutionality of the law had never been questioned, for the decision of the Supreme court affects the taxing clause only.

The Board of Control fully recognizes the advantage of a central location for the Station, with respect to state boundaries; and it is quite possible that some other location would have been chosen, had the General Assembly appropriated a sum sufficient for this purpose and permitted the selection of a site without reference to local donations of money. It is nevertheless true that the location selected combines advantages which can be secured at only a very limited number of localities in the State.

Under these circumstances, the Board of Control is unanimous in the opinion that the interests of the State and of the Station would alike suffer far greater loss from the sacrifice of property and the inevitable delay and retarding of important work, which would be involved in the attempt to re-locate the Station, than would be compensated by any possible gain from such re-location.

IMPROVEMENTS BEGUN.

Acting in this belief, the Board of Control, on July 8, contracted with the firm of Stence, Sheppard and Ames for the erection of a block of five greenhouses, covering 80x101 feet, with a stone boiler house and office attached, 24x44 feet in size, one and one-half story high, together with a separate one story stone building, 18x34 feet in size, with two greenhouses in the rear, each 14x28 feet, this smaller building being designed for the laboratory study of insects and diseases of plants. The contract price of these buildings was $11,050.00; but this does not include excavation, architect's fees, superintendence, water supply, heating apparatus, ventilating apparatus and benches. It is estimated that these items will cost about three thousand dollars, raising the total cost of the completed buildings to about $14,000. It was the intention to pay for these buildings out of the balance of the Wayne county donation, left after the purchase of land, and which amounts to $26,262.66, the entire fund arising from this donation having been appropriated to the order of the Board of Control without restriction, in a special act of the General Assembly passed February 10, 1892.

These buildings have been constructed according to contract, but the contractors have not yet received a dollar of their pay, owing to the fact that the Auditor of State has refused to honor the requisitions of the Board of Control upon the Wayne county fund, basing his action upon the fact that in the general appropriation bill of last winter the items for the improvement of the Station farm (amounting to $25,500.00) were made conditional upon the ratification by the Supreme Court of the law, authorizing the counties to raise money by taxation to secure the location of the Station.

It is hoped that the General Assembly will provide for the release of this fund at the earliest date possible.

ADDITIONAL IMPROVEMENTS NEEDED.

In our last annual report it was stated that the balance of the Wayne county donation would be used in the erection of a main office building for the Station. An architect was employed and plans were prepared for a fire-proof building for this purpose, and bids were invited for its construction. These bids were opened June 1st, but all were found to be far in excess of the funds available for the work, and therefore the plans for this building were temporarily laid aside and the greenhouses and insectary, already described, were erected instead.

The need of this main building is imperative, and for this and other improvements, all urgently needed, the following appropriations are requested:

Main office building	$45,000 00
Main barn	15,000 00
Fencing and drainage	2,000 00
Stock for fruit and forestry planting	1,000 00

We also ask for an appropriation of $500.00 for expenses of the Board of Control.

The balance of the Wayne county donation, after paying for the greenhouses and insectary, will be required for other items of improvement and outfit, enumerated in our report of last year.

PERSONNEL OF THE STATION.

No change has been made in the Board of Control during the year, Col. Brigham having been reappointed at the expiration of his term of office in May.

At the beginning of the year Mr. F. J. Falkenbach was appointed chemist to the Station and Mr. E. C. Green was promoted to the position of assistant horticulturist. Since the first of July, Mr. F. M. Webster has given his services wholly to this Station. Mr. W. H. Baker, meteorologist, severed his connection with the Station at the end of June, and Miss Freda Detmers, botanist, was unable to accompany the Station on its removal to Wooster. Both these officers had served the Station faithfully and well, and their withdrawal is felt to be a serious loss.

SUB-STATIONS.

The Sixty-ninth General Assembly appropriated $1,000 for substations for field experiments with fertilizers. This appropriation was held until the location of the central station should be definitely fixed, but is now being expended in preparing for experiment a tract of forty acres, leased for ten years for this purpose, and lying in what is known as the "oak openings" region of northwestern Ohio, this tract being in Fulton county, near the corners of Lucas and Henry counties. The soil of this region, which includes several hundred square miles, consists chiefly of yellow sand, and is totally different in character from that of the station farm. Aside from the light which systematic experiments made in this region should throw upon the management of this particular soil, they will have added value as a check upon similar investigations conducted on soils of a different character.

It is hoped that way may open for the establishment of similar sub-stations upon the clay soil which covers so large a portion of the northeastern counties, and upon some of the less productive soils of the southern part of the State.

WILLIAM R. LAZENBY,
Secretary of Board of Control.

REPORT OF THE TREASURER.

Hon. S. H. ELLIS, *President Board of Control:*

SIR:—The financial report of this Station for the fiscal year ending June 30, 1892, is herewith respectfully submitted:

An itemized statement of our account with the annual appropriation received from the U. S. Treasury is shown in statement A, this being a copy of the report made to the Governor of the State and the Secretary of the U. S. Treasury.

Our account with the produce fund is shown in statement B.

Statement C is a statement of account with the State Treasurer, showing the dates, purposes and amounts of the appropriations and the balance remaining in the treasury to the Station's credit June 30, 1892.

A statement of account, with the donation received from the commissioners of Wayne county, for the purchase of a home for the Station within the limits of that county, is shown in statement. D.

STATEMENT A.

THE OHIO AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH THE UNITED STATES TREASURY.

Dr.

1892.

To receipts from Treasurer of the United States, as per appropriation for year ending June 30, 1892, under act of Congress approved March 3, 1887 ....$ 15,000 00

Cr.

June 30,	by salaries	$ 8,270 00	
"	labor	2,916 79	
"	supplies	1,179 30	
"	freight and expressage	2 10	
"	tools and implements	259 65	
"	live stock	10 00	
"	fencing and drainage	5 74	
"	furniture and general fittings	89 04	
"	technical apparatus and supplies	468 53	
"	library	311 46	
"	printing, postage and stationery	1,012 99	
"	travel and incidentals	220 75	
"	buildings	253 65	
	Total		$ 15,000 00

We, the undersigned, duly appointed auditors for the corporation, do hereby certify that we have examined the books and accounts of the Ohio Agricultural Experiment Station for the fiscal year ending June 30, 1892; that we have found the same well kept and correctly classified as above, and that the receipts for the time named are shown to have been $15,000.00, and the corresponding disbursements $15,000.00, for all of which proper vouchers are on file, and have been by us examined and found correct.

S. H. Ellis,
R. H. Warder,
Auditors, Board of Control.

I hereby certify that the foregoing statement of account to which this is attached, is a true copy from the books of account of the institution named.

Bertha E. Wildman,
Treasurer, Board of Control.

STATEMENT B.

Ohio Agricultural Experiment Station in Account With Produce Fund.

To Receipts.

Dr.

1892.		
June 30, from sales of milk	$ 2,897 08	
" " agricultural produce	1,368 33	
" " horticultural produce	1,753 94	
" labor	42 52	
" rent	112 50	
" miscellaneous sales	69 50	
Total receipts for the year		$ 6,243 87
To balance brought forward July 1, 1891		120 21
Total		$ 6,364 08

By Expenditures.

Cr.

1892.		
June 30, for labor	$4,993 33	
" supplies	680 23	
" freight and expressage	94 36	
" tools and implements	3 82	
" live stock	105 20	
" furniture and general fittings	115 05	
" technical apparatus and supplies	7 88	
" library	29 85	
" printing, postage and stationery	20 67	
" travel and incidentals	275 23	
" buildings (labor, $ 26.36, material, $ 2.25)	28 61	
Total expenditures		$ 6,354 23
By balance carried forward		9 85
Total		$ 6,364 08

STATEMENT C.

STATEMENT OF ACCOUNT OF THE OHIO AGRICULTURAL EXPERIMENT STATION WITH STATE TREASURY.

Date of appropriation.	Appropriation for—	Receipts.	Expenditures.	Balance in treasury June 30, 1892
1891	Fire-proof safe, office furniture and museum cases	$ 800 00	$ 367 25	$ 432 75
	Field experiments with insect enemies and fungous diseases of plants	600 00	600 00	....
	Sub-station for field experiments with fertilizers	1,000 00	....	1,000 00
	Repairs and improvements	300 00	300 00	....
	Expenses of Board of Control	200 00	200 00	....
	Illustrating bulletin	500 00	118 60	381 40
1892	Spraying experiments	500 00	....	500 00
	Expenses of Board of Control	372 24	278 10	94 14
	Total for 1891 and 1892	$ 4,272 24	$ 1,863 95	$ 2,408 29
	Balance of appropriations for 1890, brought forward July 1, 1891—			
	For finishing and furnishing museum and library	176 71	176 71	....
	For expenses of Board of Control	95 85	95 85	....
	Totals	$ 4,544 80	$ 2,136 51	$ 2,408 29

STATEMENT D.

OHIO AGRICULTURAL EXPERIMENT STATION IN ACCOUNT WITH DONATION FROM WAYNE COUNTY.

RECEIPTS.

1892.		
From Commissioners of Wayne county		$85,000 00

EXPENDITURES.

June 30, for farm in Wayne county	$58,578 25	
" surveyor's and abstractor's fees	49 90	
		$58,628 15
By balance, carried forward		26,371 85
Total		$85,000 00

The above four statements are combined in the following statement E, which shows the total income and expenditures of the Station for the fiscal year:

STATEMENT E.

TOTAL RECEIPTS AND EXPENDITURES OF THE OHIO AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING JUNE 30, 1892.

RECEIPTS.

From U. S. Treasury	$15,000 00	
“ farm produce, etc	6,243 87	
“ State appropriations for 1891	3,400 00	
“ “ “ “ 1892	872 24	
“ donation of Wayne county	85,000 00	
Total receipts		$110,516 11
Balance brought forward July 1, 1891		392 77
Total		$110,908 88

EXPENDITURES.

For salaries	$8,2 0 00	
“ labor	8,248 72	
“ supplies	1,984 50	
“ freight and expressage	96 46	
“ tools and implements	320 47	
“ live stock	115 20	
“ fencing and drainage	5 74	
“ furniture and general fittings	571 34	
“ technical apparatus and supplies	476 41	
“ library	341 31	
“ printing, postage and stationery	1,152 26	
“ travel and incidentals	575 41	
“ buildings (material and labor)	758 97	
“ expenses Board of Control	573 95	
“ farm in Wayne county	58,628 15	
Total expenditures		$82,118 89
By balance, carried forward		28,789 99
Total		$110,908 88

PERMANENT IMPROVEMENTS

From the total expenditures, shown in statement E, the following amounts were used in permanent improvements on the farm at Columbus:

STATEMENT F.

Buildings, (material and skilled labor)	$694 60	
“ (ordinary labor)	64 37	
Fencing and drainage, (repairs)	5 74	
Total		$764 71

BERTHA E. WILDMAN,
Treasurer.

REPORT OF THE DIRECTOR.

Hon. S. H. Ellis, *President of the Board of Control*:

Sir: The eleventh annual report of the Ohio Agricultural Experiment Station, for the year 1892, is respectfully submitted, this being my fifth report as Director:

THE SEASON.

During the first half of the growing season, rainy weather prevailed almost incessantly over Ohio, especially over the middle and northern portions of the state. On the undrained, flat lands of the central counties many fields intended for corn were abandoned, after having been partly prepared, and many more received such insufficient cultivation that the crop was almost a failure. At one time it seemed impossible that sufficient corn could be produced for home consumption, yet such is the recuperative power of this plant that a fair crop was finally harvested over the State as an average.

THE STATION'S WORK.

Last winter the General Assembly appropriated $500 to be used by the Station in continuing experiments in the control of insects and fungous diseases of plants. Arrangements were made to continue these experiments on the lines followed the previous season, with such modifications as experience had indicated. At one time it seemed that the whole work would be rendered abortive by the continuous rains, but the final results, given in the report of the Horticulturist, show that the actual benefit from spraying orchard trees may be even greater in a wet season than in a dry one.

In other lines of work the object has been to gain further evidence respecting questions already under investigation; for each season's experience more fully exhibits the necessity of piling test upon test in agricultural experiment.

REMOVAL OF THE STATION.

The transfer of our base of operations to the new home of the Station in Wayne county has necessarily involved a large expenditure of energy that would otherwise have gone into the proper work of the

Station. This transfer was delayed until after wheat harvest, in order to complete the field tests of the season with the wheat crop. On the first of September the headquarters of the Station were removed from Columbus to Wooster, and since that date we have been engaged in preparing the farm here for experimental work. This preparation has been seriously impeded by the refusal of the Auditor of State to permit the withdrawal from the State treasury of the funds donated by Wayne county for the improvement of the farm, and a year's loss of time in some of the most important work of the Station will be the result.

NEW BUILDINGS.

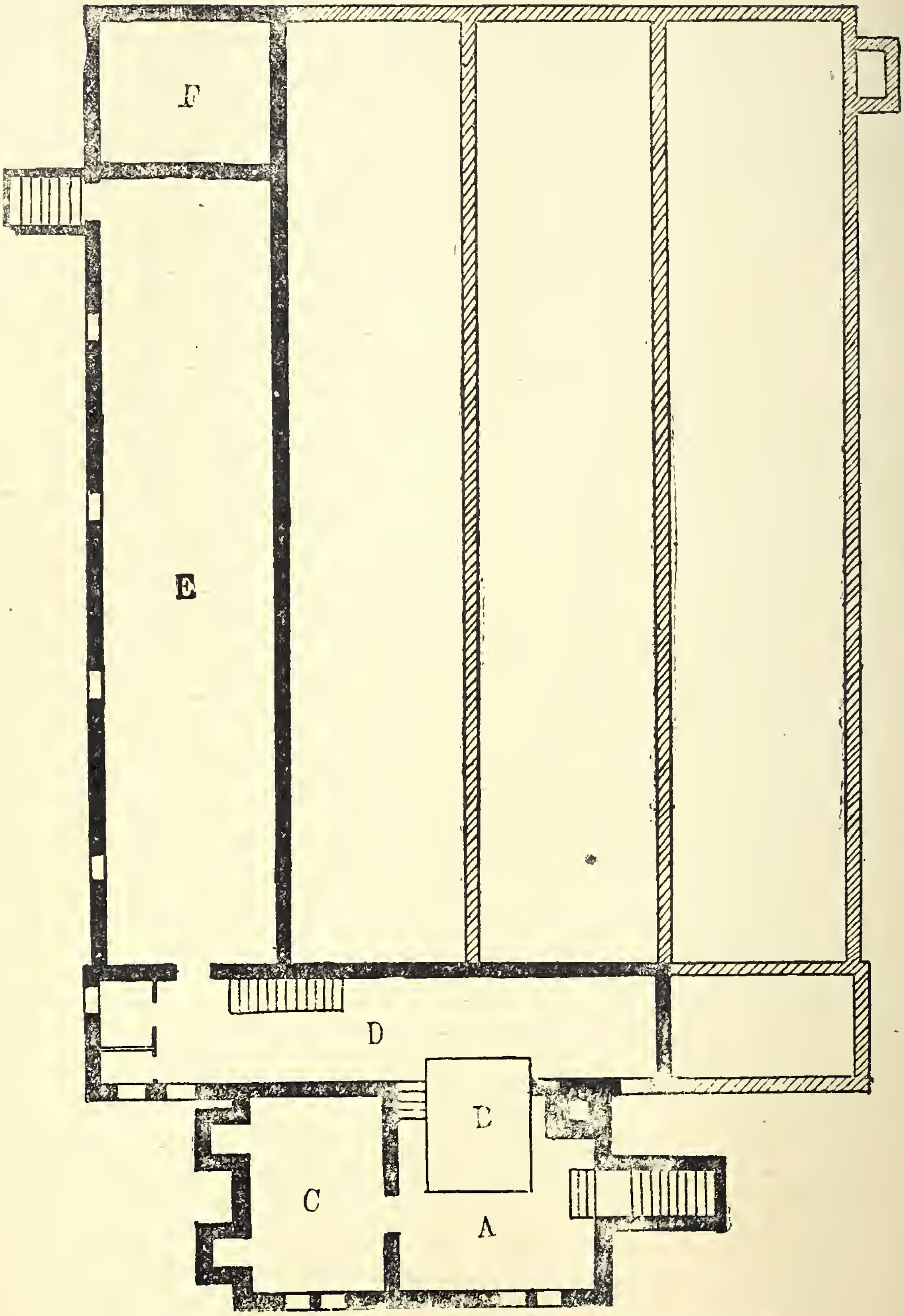
The equipment of the new Station at Wooster has been commenced by the erection of two buildings, the one a combination of boiler house, greenhouses and greenhouse offices, shown in plans I and II, and the other a building to be devoted to the study of insects and fungous diseases of plants, shown in plan III.

The boiler house is a stone building, 24 x 40 feet in size, one and one-half story high, with a deep basement to contain the boilers. It is proposed to heat from these boilers not only the greenhouses in the rear of the boiler house, but also the main building of the Station, to be hereafter erected, and which will be located in front of the boiler house.

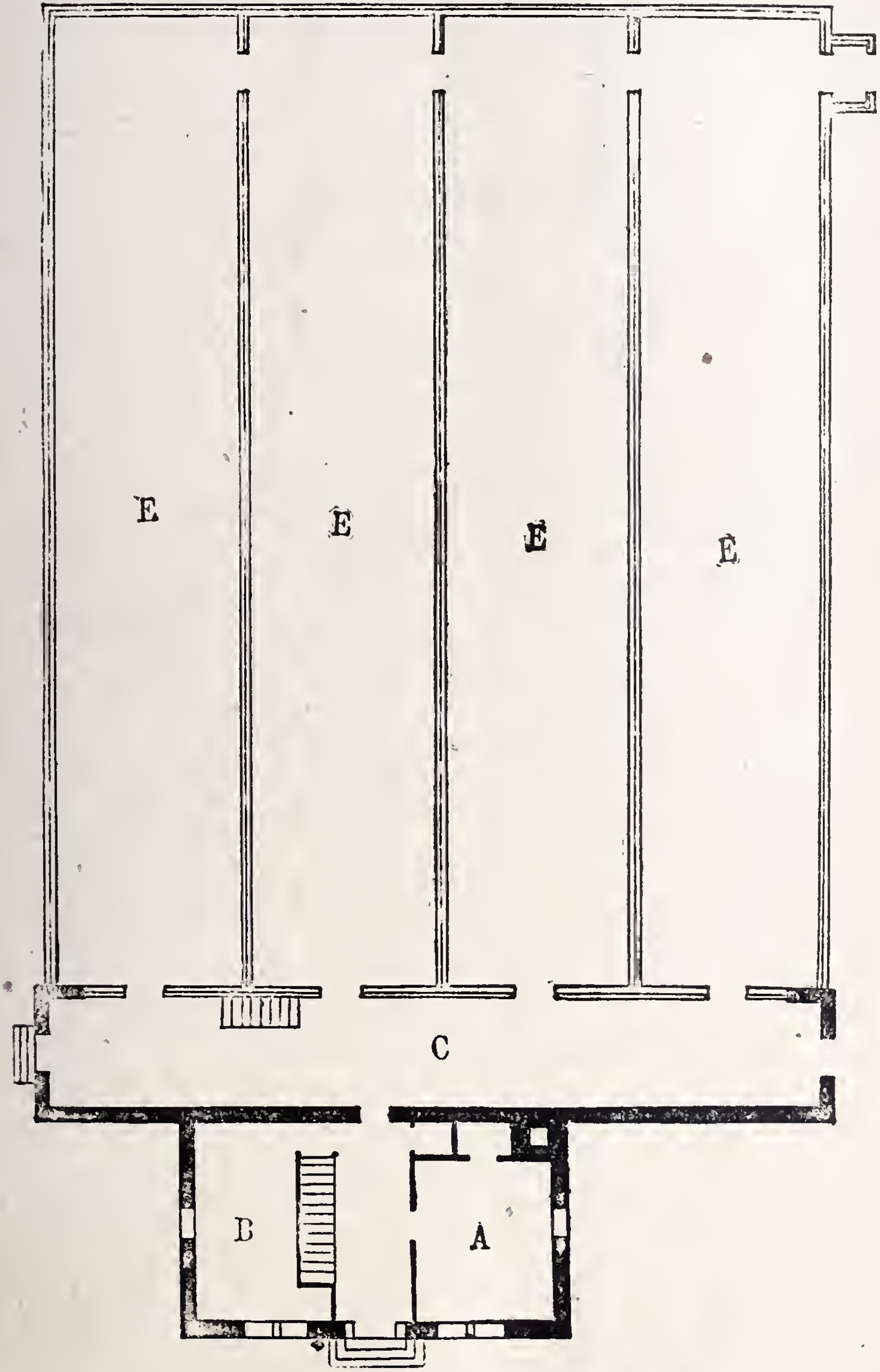
In plan I, A is the boiler room; B, boilers; C, coal room; D, cellar under arcade (for distribution of heating pipes and passage); E, mushroom cellar; F, cistern.

In plan II, A is an office; B, seed room; C, arcade; E, E, E, E, greenhouses. The "arcade" is roofed with tin over the part joining the boiler house, so that this part may be used as a potting room. The stairway in the main hall leads to a hall above, on each side of which is a room designed for janitor's or assistant's use.

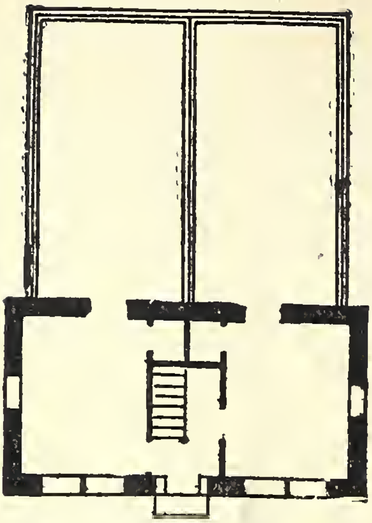
In plan III, the front part is a one story stone building, 18 by 34 feet in size, containing two small laboratories, separated by hall and stairway, and each opening into a greenhouse in the rear, 14 x 28 feet in size.



PLAN I.—Basement and foundation of boiler house and greenhouses.



PLAN II.—Ground-floor of boiler house and greenhouses.



PLAN III.—Insectary.

The stone used in these buildings is a yellowish sandstone, slightly tinged with green, found on the premises. The greenhouse walls are built of hollow bricks, 10 inches wide, with a septum through the middle.

The main greenhouses are each 20 feet wide by 100 feet long. They are separated by hollow-brick walls, in order to facilitate experiments in heating.

FARMERS' INSTITUTES.

Through the courtesy of Mr. L. N. Bonham, secretary of the State Board of Agriculture, the members of the station staff have had the privilege of meeting many of the best farmers of the State in their institutes. We feel that such intercourse promotes a better understanding by both farmers and station workers of the nature and difficulties of the problems, which demand the station's attention.

DAIRY TESTS.

In coöperation with the State Board of Agriculture the station has superintended the testing of several cows of different breeds during the year. The station stands ready to assist in any practicable manner in determining the relative value of the different breeds of cattle, and it is earnestly hoped that a way may soon open by which the great live stock and dairy interests of our State may receive attention proportionate to their importance.

PUBLICATIONS.

The publication of the station's bulletin has been seriously interfered with by the extra work incident to the removal, which has made it impossible to prepare for publication a large amount of material already in hand. This material will be prepared and published as rapidly as possible.

Our newspaper bulletin, published by coöperation with the CENTRAL PRESS ASSOCIATION of Columbus, has reached its 114th number, and members of the station staff have contributed frequently to the agricultural press during the year.

Following is summary of the contents of the ten numbers of the regular bulletin issued during the year:

BULLETIN NO. 1, VOL. V., JANUARY, 1892, BY J. FREMONT HICKMAN.

Field experiments with oats, including comparison of varieties, distribution of seed, methods of planting and treatment for smut.

SUMMARY.

Varieties: These experiments extended over two seasons, 1890 and 1891, and included fifty-four differently named lots in the variety tests. The season of 1890 was very unfavorable, all varieties suffering from a hitherto undescribed disease, which reduced the average yield by more than half. The largest yields were given by Improved American, Dakota Gray, white Canadian and State of North Dakota, these four varieties producing thirty-three bushels per acre and over. Monarch, Early Dakota, Black Tartarian and Wideawake stand next.

The season of 1891 was favorable, and the largest yields were given by Prince Edward's Island, Black Tartarian, Dakota Gray, Black Prolific, Seizure, Giant Yellow French, Golden Giant, Rust Proof, Early Swedish, Japan and Improved American, all of these except Improved American and Rust Proof having a compact or one-sided panicle.

In a series of tests extending over six years, the varieties that have given the largest yields are Probsteier, Early Dakota, Black Tartarian, Monarch, State of North Dakota, Rust Proof, Kansas Hybrid, White Schoenen and Black Russian.

After two years' trial the Virginia Winter Oats is discarded as not adapted to our climate.

Seed per acre: In general, the more seed sown per acre in the abnormal season of 1890, the higher the product. In 1891, seeding at the rate of seven and eight pecks per acre produced a larger crop than either heavier or lighter seeding.

Depth of planting,—Drilling vs. broadcasting: In the two season's experiments larger crops of oats have followed planting from one to two inches deep than from deeper planting. A slight advantage is indicated for seeding with the drill as against broadcasting.

Treatment for smut: The "Jensen," or hot water treatment, (soaking the seed for a few minutes in water heated to about 135 degrees Fah.) for preventing smut has given good results, and is commended for further trial by farmers.

BULLETIN NO. 2, VOL. V., FEBRUARY, 1892, BY J. FREMONT HICKMAN.

Field experiments with mangolds and sugar beets, including comparison of varieties, transplanting, continuous cropping with and without manures, disposal of leaves and suggestions for beginners in beet culture.

SUMMARY.

Varieties: In the Long Red class of mangolds the Giant Long Red has, in a series of years, seemed to have more vitality in the seed used, and has given a more satisfactory average growth than any other one of that class.

The Giant Holstein, Dignity and Jumbo have all made occasional higher yields than the Giant Long Red, and are among the best sorts in that class.

The Giant Yellow Intermediate, Yellow Ovoid and Yellow Leviathan are among the better kinds in the Ovoid class.

The Globe class as a whole has been the least valuable type of mangolds.

According to the experiments detailed in this bulletin, an acre of sugar beets, properly grown, is decidedly more valuable for feeding stock than an acre of mangold wurzels.

The sugar beets grown at this Station during the past year have shown a percentage of sugar too small to justify growing them for sugar making purposes.

Transplanting: Transplanting mangolds has not been attended with satisfactory results, except in filling up rows to make a more perfect stand.

Cutting off the leaves when transplanting has not been any benefit.

Manuring: Manuring land with fresh barn yard manure has in every case decreased the yield of mangolds.

Continuous cropping with mangolds has resulted in reducing the ability of the land to produce this crop by at least 10 per cent. each year for the first three years.

Disposal of leaves: Preserving the leaves in the silo with corn ensilage has not been found practicable.

It has been found possible to preserve them in a well or cistern in the ground with but little loss, but they were not relished by the stock, even when well kept.

On account of the large proportion of fertilizing elements in the leaves, it is advisable to leave them upon the ground.

BULLETIN NO. 3, VOL. V, MARCH, 1892, BY C. E. THORNE AND J. FREMONT HICKMAN.

Field experiments with commercial fertilizers, including experiments on corn and oats grown continuously, coöperative experiments on corn by farmers, and experiments on crops grown in rotation.

SUMMARY.

Fertilizers on corn: In the experiments with fertilizers on corn, superphosphate and potash, used separately or in combination, have as often caused loss as gain in the crop, unless nitrogen was also added.

In those cases where superphosphate seemed to have a favorable influence independent of nitrogen, gypsum also proved beneficial, indicating that a part of the effect of the superphosphate was due to the gypsum contained.

Nitrate of soda has generally increased the crop when used alone, and when used in combination with superphosphate and potash, one or both, it has caused an increase in practically every case.

Cost of fertilizers and value of increase: While there have been cases in which the increase of crop apparently due to the fertilizer has been sufficient to pay the cost of the fertilizer, it has been impossible to repeat this result on duplicate plots through successive seasons, thus indicating that in such cases the increase was largely due to accidental variations in the soil.

Fertilizers on oats: In the experiments on oats the fertilizers have apparently produced an increase of crop in practically every case, the increase being more uniform when the fertilizer contained nitrogen; but at present prices of grain and fertilizers respectively, the average increase has in no case been sufficient to pay the cost of the fertilizer.

Fertilizers on crops grown in rotation: The experiments on crops grown in rotation have not yet been carried over a sufficient length of time to justify general conclusions; but thus far they offer no more encouragement to the use of chemical manures than those on crops grown continuously.

Value of stable and yard manures: A very wide difference is indicated in the value of stable manure according as it is used fresh from the stable or after half a year's leaching in the barnyard. Apparently the margin of profit in the use of open yard manure is extremely meager.

BULLETIN NO. 4, VOL. V, APRIL, 1892, BY F. M. WEBSTER.

Insects which burrow in the stem of wheat, an illustrated description of eight species of insects having this habit.

SUMMARY.

The Joint Worm, *Wheat Straw Worm*, and *Wheat Stem Saw-fly* all belong to the same order of insects as the ant, bee and wasp. The eggs are deposited in the growing stems, and the insect passes the fall and winter in the stubble.

Burning the stubble will probably destroy the majority of the inscts in the field, while a rotation of crops will do much to prevent their becoming abundant,

The Grain Sphenophorus destroys wheat by burrowing in the basal joints or the straw. This is one of quite a number of species which do serious injury to corn, being known as corn Bill-bugs.

The Stalk-borer is a near relative of the cut-worm and army worm, but departs from the habits of these last by burrowing in the stems of wheat and other grains. Little damage is done to wheat, its chief injury being among corn and vegetables.

The Wheat Stem Maggot is the young of a small fly which deposits its eggs on the leaves of growing wheat and grass in spring, summer and fall. The maggots burrow in and destroy the tender, growing stems, and are particularly noticeable in wheat fields just before harvest, when they work just above the upper joint, causing the heads of the grain to wither and turn white. At other times they cause the center of the plant to turn yellow and die. Sowing plats of wheat in mid-summer, and plowing these under in September, will destroy many of the larvæ, as will also the destruction of volunteer wheat. Some varieties of wheat are attacked more severely than others.

The Companion Wheat-fly and the *American Frit-fly* are small dark colored flies resembling minute house flies. The habits of their larvæ are much the same as those of the wheat stem maggot, and similar remedies and preventives will probably be found equally effective.

BULLETIN 42 (VOL. V, NO. 5) AUGUST, 1892, BY J. FREMONT HICKMAN.

Field experiments with wheat, including methods of seeding, wheat after melilotus, shrinkage in the granary, degeneration of varieties, comparative test of varieties, "scab" and smut.

SUMMARY.

Methods of seeding. Previous experiments at this Station have not shown wide variations in yield between wheat drilled and sown broadcast; this year's experiment indicates clearly that of the two methods, drilling is decidedly the better.

Cross drilling has apparently been of some advantage this year, although the results of a similar experiment made a year ago, do not agree with those of this season.

Mixing two varieties and drilling them together has been of no advantage, last year or this.

Wheat after melilotus. A single experiment indicates that sterile clays may sometimes be rendered comparatively productive at slight expense by the growth of melilotus, or Bokhara clover.

Shrinkage in the granary. Wheat threshed from the shock, but in dry condition, lost a little over two per cent in weight in three years. In a wet season wheat increased slightly in weight from January to July.

Degeneration of varieties. Varieties grown twelve years in succession, without change of seed, show no evidence of deterioration. Selected seed has given a better quality of grain in the crop, but no marked increase in yield as yet.

Varieties. Judging from the experience of this and former years, we recommend the following sorts of wheat as probably the safest for general culture throughout Ohio: Valley, Fultz, Velvet Chaff (Penquite,s), Egyptian and Nigger. Diehl-Mediterranean, under its various names, has given good yields on this farm and in favored localities, but can not be recommended for general culture, and the same may be said of Martin's Amber, and its synonyms Landreth and Silver Chaff. Rudy, Deitz, Poole, Currell's Prolific, Early Red Clawson, Hicks and Jones' Winter Fife are worthy of further trial.

Smut and scab. Stinking smut was present in almost every variety of wheat grown, but not sufficient in any one to do material injury to the crop of this year.

Loose smut damaged the Hicks (and its synonym, Hickman) wheat at least eight per cent; other varieties very little.

The scab damaged later varieties of wheat most, and did greater injury to the earlier ripening wheats where the ground was poorly prepared or imperfectly drained, causing them to ripen later than they would under favorable conditions.

BULLETIN 43 (VOL. V, NO. 6) SEPTEMBER, 1892, BY W. J. GREEN, E. C. GREEN, W. S. TURNER, E. V. WILCOX AND F. M. WEBSTER.

Greenhouses and greenhouse work, by W. J. Green, E. C. Green and W. S. Turner, including methods of piping, fertilizers in the greenhouse, sub-irrigation in the greenhouse, the water bench, crops suitable for forcing, calendar of operations, lettuce and tomatoes as greenhouse crops.

SUMMARY.

Fertilizers in the greenhouse. A rich compost was used, as is customary in such work, and the problem proposed was to determine whether nitrate of soda and other nitrogenous fertilizers could be used with profit on crops grown in such soils. No chemical fertilizer, either singly or in combination, was found to be of any value for lettuce, radishes, cucumbers and tomatoes. On poorer soils the case might be quite different, but a compost composed largely of manure is a necessity in the greenhouse, and such a compost usually contains a sufficient supply of plant food, and in a cheaper form than can be found in chemical fertilizers.

Sub-irrigation in the greenhouse. Beds were so constructed as to admit of watering by means of sub-irrigation, through drain tiles laid two and one-half feet apart. All the water required by the plants was supplied in this manner, and none was applied to the foliage. The result on lettuce was very marked, the gain of sub-irrigated over surfaced-watered plants being about fifty per cent. Sub-irrigated radishes came to maturity several days earlier than those watered in the ordinary manner. Cucumbers were greatly benefited by sub-irrigation, but tomatoes thus treated showed only a small gain over those watered in the ordinary manner.

The water bench. This is a water-tight bench, and is used for the purpose of watering plants which are grown in flats or trays, holding about two inches of soil, and having slatted bottoms. A small quantity of water is poured into the water bench and the trays are set in the water for a short time. This is simply an extension of sub-irrigation. and is the best method of watering seed just after sowing and all kinds of small plants in flats. Recent results indicate that a crop of lettuce can be brought to maturity from one to two weeks earlier by this plan than by the ordinary method.

Crops suitable for forcing. Almost any crop can be grown in the greenhouse, but lettuce, mushrooms, radishes and tomatoes pay best. Cucumbers, beans, dandelion, cauliflower and pie-plant may be grown with some profit.

Tomatoes as a spring and summer crop. It has been found to be more profitable here, to grow tomatoes in the greenhouse after the lettuce season is past, than to occupy the house with them during the winter. The seed is sown about the middle of December, and the plants are twice transplanted before they are set into permanent beds for fruiting. About the middle of March the plants are set in the beds about two feet apart each way. The plants are trained to a single stem, and tied to stakes or some other support. Acme, Beauty, Perfection and Dwarf Champion are suitable varieties for the purpose.

Lettuce as a greenhouse crop. The first sowing should be made in September, and others should follow at intervals of three or four weeks thereafter, until about the last of January. Seed is sown in flats and when large enough the plants are transplanted into flats, 2 x 2 inches apart, where they remain three or four weeks, when they are again transplanted, but into beds, 6 x 8 inches apart. About twelve weeks from the date of sowing is the time required for a crop to come to maturity, but only about half of this period are the beds fully occupied, hence several successive crops can be brought forward at the same time.

About thirty cents per square foot of greenhouse space is a fair estimate for the returns from the lettuce crop during the season, which does not include other crops that may be grown at the same time under the benches. Grand Rapids is the most profitable variety to grow, except in localities where the market demands the heading varieties.

Bulletin 43 also includes a paper on *The Food of the Robin*, by E. V. Wilcox, W. J. Green and F. M. Webster, being a summary of the examination of the stomachs of 74 robins, taken at different times during the season, from which it appears that in general the robin subsists upon the food which is most easily obtained. During the time when berries are plentiful the robin eats but little else; at other times he takes insects and seeds of various kinds. The amount of fruit taken is often a serious tax upon the small small fruit grower, and many of the insects destroyed by the robin are beneficial.

On the other hand, he takes some injurious insects, and many that are not known to be either beneficial or injurious, hence it is not easy to determine just how much blame or credit should be given the robin. To many fruit growers he possibly does more harm than good, but to the general public the reverse is no doubt true, hence it appears that the tribute which the robin exacts is borne by a few and justice requires that those, who would protect their crops from his depredations, should be allowed to do so, without fear of arrest. There does not appear to be any cause, however, for any general effort to exterminate the robin.

BULLETIN 44 (VOL. V, NO. 7) SEPTEMBER, 1892, BY FREDA DETMERS, C. E. THORNE AND A. D. SELBY.

A preliminary list of the rusts of Ohio, by Freda Detmers. An enumeration of species of Uredinæ observed in the state.

Wild lettuce—a pestiferous weed, by C. E. Thorne, A. D. Selby and Freda Detmers. An account of rapid spread of this weed over the Station farm, with illustrated description.

Scab of Wheat, by Freda Detmers. A technical description of this fungus, illustrated.

BULLETIN 45 (Vol. V, No. 8) DECEMBER, 1892, BY F. M. WEBSTER.

Insects Affecting the Blackberry and Raspberry.

SUMMARY.

The Bulletin considers all species of insects known to the author as in any manner affecting plants of the genus Rubus, but especially the Blackberry and Raspberry. All species are included without respect to the injury they do to these plants, for the reason that the fruit grower is often at a loss to distinguish those that are almost sure to ravage his crop, from those that are little likely to do so. Besides, many species that work little injury to these fruits are veritable pests on some others. Therefore, all are treated quite fully, and separated by numbers into divisions according to the amount of damage they are likely to do. There is also another separation, by numbers, whereby each species falls under the remedial measure or measures most likely to afford relief.

BULLETIN 46 (Vol. V, No. 9) DECEMBER, 1892, BY F. M. WEBSTER.

Underground Insect destroyers of the Wheat plant.

SUMMARY.

Wire worms are the larvæ or grubs of snapping or click beetles, and breed especially in low, damp, cold soils, feeding on the roots of grass and, probably, other herbaceous plants. They probably require a little over three years to develop from egg to the adult. No thoroughly practical method of destroying the worms has yet been discovered. Their numbers may be reduced by fall plowing, and their haunts rendered unattractive by a rapid rotation of crop and by underdrainage. Where fields of corn are attacked and replanting made necessary, it is best to plant the second time between the old rows, allowing the latter to stand as long as possible in order to hold the attention of the worms and keep them diverted from the latter plants.

White Grubs are the offspring of the May beetles or June bugs. While the wire worms develop to adults in summer and live over winter in that stage, the white grubs pass the winter either as grubs or pupæ and develop to adults in spring, otherwise the life history of the two are much the same. The eggs are laid in the ground, notably in grass lands, and hatch in about 30 days. The young work little injury the first year, but the next they ravage the fields most seriously. These prefer the higher to the lower lands and therefore drainage has much less effect upon them. Probably fall plowing and rapid rotation of crop are the two best methods to pursue. Fertilizing with barnyard manure is a protection against damage in infested fields.

Crane flies are known also as Gallinippers, and many term them cut-worm flies, though they have no connection with cut-worms. There are a number of species of these, some of which are one and others two brooded each year. The eggs are deposited in grass and clover land, more particularly in low, flat, damp lands. The maggots feed on the roots, seldom appearing above ground except in very wet weather. The ravages of these larvæ can be prevented among wheat lands by plowing these early in September. This measure will also preclude the probability of injury to corn the following year. For injuries in grass or clover lands no remedy or preventive is as yet known.

ACKNOWLEDGMENTS.

The publishers of the following journals have aided the Station in its work during the year, either by republishing abstracts from its bulletins or by donating their publications to its library:

AGRICULTURAL PAPERS OF OHIO.

American Grange Bulletin, Cincinnati.
Farm and Fireside, Springfield.
Farmer's Home, Dayton.
Gleanings in Bee Culture, Medina.
Ohio Farmer, Cleveland.
Stuart's Agriculturist and Stock Breeder, Cleveland.

GENERAL PAPERS OF OHIO.

Arcanum Enterprise, Arcanum.
Attica Journal, Attica.
Auglaize County Democrat, Wapakoneta.
Bakersville Press, Bakersville.
Barnesville Republican, Barnesville.
Cincinnati Price Current, Cincinnati.
Cincinnati Weekly Commercial Gazette, Cincinnati.
Columbus Record, Columbus.
Cortland Herald, Cortland.
Crestline Advocate, Crestline.
De Graff Buckeye, De Graff.
Democratic Herald, Delaware.
Democratic Record, Chardon.
Frederickstown Free Press, Frederickstown.
Fremont Journal, Fremont.
Geauga County Record, Chardon.
Geauga Leader, Burton.
Greenville Democrat, Greenville.
Herald, Middleport.
Industrial News, Toledo.
Jacksonian, Wooster.
Kenton Graphic News, Kenton.
Leader, Chillicothe.
Lewisburg Reporter, Lewisburg.
Lodi Review, Lodi.
Malta Register, Malta.
Monroe Journal, (German), Woodsfield.
Northern Ohio Journal, Painesville.
Ohio State Journal, Columbus.
Painesville Telegram, Painesville.
Plain City Dealer, Plain City.
Press, Columbus.
Republican Leader, New Lisbon.
Shelby News, Shelby.
Tuscarawas Advocate, New Philadelphia.
Tuscarawas Chronicle, Uhrichsville and Dennison.
Union County Journal, Marysville.

Valley Enterprise, Milford.
Wayne County Democrat, Wooster.
Wayne County Herald, Wooster.
West Liberty Banner, West Liberty.
Wood County Democrat, Bowling Green.
Wooster Journal, Wooster.
Wooster Republican, Wooster.

MISCELLANEOUS PAPERS.

Agricultural.

Acker und Gartenbau Zeitung, Milwaukee, Wis.
Agricultural Epitomist, Indianapolis, Ind.
Agricultural Journal, Montgomery, Ala.
Agricultural Science, State College, Pa.
Agricultural Gazette, New South Wales.
American Agriculturist, New York, N. Y.
American Gardening, New York, N. Y.
American Homestead, Omaha, Neb.
American Rural Home, Rochester, N. Y.
Breeder's Gazette, Chicago, Ill.
California Cultivator and Poultry Keeper, Los Angeles, Cal.
Canadian Entomologist, London, Ont., Canada.
Colman's Rural World, St. Louis, Mo.
Dairy Messenger, Chicago, Ill.
Dakota Farmer, Huron, South Dakota.
Farm and Home, Chicago, Ill., and Springfield, Mass.
Farmers' Advocate, London and Winnipeg, Canada.
Farmers' Voice, Chicago, Ill.
Farm, Field and Fireside, Chicago, Ill.
Farm Implement News, Chicago, Ill.
Farm, Stock and Home, Minneapolis, Minn.
Florida Agriculturist, De Land, Fla.
Fruit-Growers' Journal, Cobden, Ill.
Grange Visitor, Lansing, Mich.
Holstein Friesian Register, Boston, Mass.
Home and Farm, Louisville, Ky.
Husbandman, Binghamton, N. Y.
Industrial American, Lexington, Ky.
Indiana Farmer, Indianapolis, Ind.
Journal of Agriculture, St. Louis, Mo.
Maritime Agriculturist, St. John, N. B.
May Flower, Floral Park, N. Y.
Mirror and Farmer, Manchester, N. H.
National Stockman and Farmer, Pittsburgh, Pa.
New Dairy, New York, N. Y.
Orange Judd Farmer, Chicago, Ill.
Pacific Rural Press, San Francisco, Cal.
Practical Farmer, Philadelphia, Pa.
Prairie Farmer, Chicago, Ill.
Rural New Yorker, New York, N. Y.
Rural Northwest, Portland, Oregon.
Southern Cultivator and Dixie Farmer, Atlanta, Ga.
Southern Planter, Richmond, Va.

Sugar Beet, Philadelphia, Pa.
Weekly Globe and Canadian Farmer, Toronto Canada.
Western Breeder, St. Joseph, Mo.
Western Farmer and Stockman, Sioux City, Iowa.
Western Resources, Lincoln, Neb.
Western Stockman and Cultivator, Omaha, Neb.
Western Swineherd, Geneseo, Ill.
Wisconsin Farmer, Madison, Wis.

General.

Baltimore Weekly Sun, Baltimore, Md.
Boston Globe, Weekly, Boston, Mass.
Detroit Free Press, Weekly, Detroit, Mich.
Engineering and Mining Journal, New York, N. Y.
National Provisioner, New York, N. Y.
Pharmaceutical Era, Detroit, Mich.
Press, The Weekly, New York, N. Y.
Press, The Weekly, Philadelphia, Pa.
Science, New York, N. Y.
Union, The Weekly, Manchester, N. H.
World, The Weekly, New York, N. Y.

IMPLEMENTS, SEEDS AND PLANTS RECEIVED.

Thanks are returned for the following donations to the Station:

AGRICULTURAL DEPARTMENT.

J. E. Hedges, Ashville, O., one set of listers.
Deere & Co., Moline, Ill., spring tooth cultivator.
Bucher & Gibbs Plow Co., Canton, O., tubular roller.
Currie Bros., Milwaukee, Wis., one-fourth pound rape seed.
F. Barteldes & Co., Lawrence, Kansas, one pound Kaffir corn.
F. Barteldes & Co., Lawrence, Kansas, one pound Jerusalem corn.

HORTICULTURAL DEPARTMENT.

Barteldes & Co., Denver, Colo., several varieties of seeds.
L. K. Ballard, Warren, Ill., raspberry plants.
S. Buffington, Kesler, O., strawberry plants.
C. P. Bauer, Judsonia, Ark., strawberry plants.
Wm. Belt, Williamsburg, O., strawberry plants.
Isaac Clawson, Osage, Iowa, strawberry plants.
R. S. Cole, Harmans, Md., strawberry plants.
C. S. Curtice, Portland, N. Y., Early Ohio grape vine.
T. J. Dyer, Cornwall, N. Y., strawberry plants.
U. S. Department of Agriculture, seeds, cuttings scions and plants.
R. S. Edwards, Highlands, Colo., strawberry and raspberry plants.
Frank Ford & Son, Ravenna, O., potato.
Boswell Fox, Manchester, Ky., strawberry plants.
D. M. Ferry & Co., Detroit, Mich., beans.
Geo. S. Josselyn, Fredonia, N. Y., red jacket gooseberry, Esther and Rockwood grapes.
S. F. Leonard, Chicago, Ill., seeds.
Frank Murphy, Donnellsville, O., raspberry plants.

A. C. Maxwell, Lawrence, Kansas, blackberry plants.
Wm. Mendenhall, Marion, Ind., strawberry plants.
McMath Bros., Onley, Va., strawberry plants.
Chas. E. Pennock, Bellevue, Colo., cherry trees.
C. S. Pratt, Reading, Mass., strawberry plants.
Lewis Roesch, Fredonia, N. Y., gooseberry plants.
T. L. Ray, East Chardon, O., strawberry plants.
Slaymaker & Son, Dover, Del., strawberry plants.
Frank H. Smeltzer, Van Buren, Ark., strawberry plants.
The Storrs & Harrison Co., Painesville, O., currant plants.
J. F. Thompson, Oneida, O., raspberry plants.
H. G. Wolfgang, strawberry plants.
A. M. Nichols, Granville, O., tomato seed.
Wm. Stahl, Quincy, Ill., spraying nozzle.

The purpose of the listers above mention is to regulate the depth of planting corn. The implement can be attached to any planter, and does its work to our entire satisfaction.

The spring tooth cultivator is designed for shallow cultivation, and, after a season's trial, we heartily recommend it for such work.

We consider the tubular roller superior to any smooth roller for pulverizing the soil. We find it a well made and durable implement.

The seeds and plants will be reported upon in future bulletins.

In conclusion, I have again the pleasure of reporting a year of harmonious and earnest effort on the part of all connected with the station. The Board of Control has acted as a unit at all times, and both the members of the board and my co-workers of the station staff have cheerfully submitted to serious personal inconvenience in order to advance the station's work.

Respectfully submitted,

CHAS. E. THORNE, *Director*.

REPORT OF THE AGRICULTURIST.

In consequence of the Station taking possession of the farm in Wayne county early in April, 1892, and in anticipation of the removal of the entire station during the year, the work of this department was in some respects necessarily curtailed, while in others the possession of both farms during the greater part of the growing season has been of some advantage. The experiments in the field have constituted as usual the larger share of the work done. The following is a brief summary of the plans that have been carried out in detail:

Wheat: A series of cultural experiments, the plan and results of which have been published in Bulletin No. 5 of this volume, a summary of which is given in the report of the director. Also, a series of experiments in the application of commercial and other fertilizers to wheat, the results of which will appear in a future bulletin.

Oats: (1.) A variety test of forty-four differently named sorts was conducted on the farm in Wayne county.

(2.) A comparison of yields from the use of different fertilizers was continued on the farm hitherto occupied by the Station in Franklin county.

The variety test conducted in Wayne county was rather unsatisfactory, owing to irregular and imperfect drainage.

Corn: (1) (*a*) Thirty-four varieties of dent corn were grown in a comparative test, both on the farm at Columbus and upon the station farm near Wooster. (*b*) Twelve varieties of ensilage corn were grown in a comparative test at Columbus. (*c*) Eight or nine varieties highly recommended by seedsmen were sent out to farmers over the State to ascertain if they would mature upon Ohio soils.

(2.) Experiments were continued on the farm at Columbus, in methods of planting and culture, including, (*a*) contrasting deep and shallow tillage; (*b*) testing vitality of seed by planting continuously seed from the same parts of the ear; (*c*) detasseling every other row; (*d*) pulling suckers off *vs.* leaving them on. Experiments with chemical and other fertilizers were conducted upon both the station farm at Wooster and the farm at Columbus, as well as in several other counties of the State.

In addition to the above experiments with commercial manures upon wheat, oats and corn, a block consisting of thirty-five one-twentieth acre plots has been devoted to a system of rotation in the order of corn, oats, wheat and clover and timothy two years. This gives the commercial fertilizers an opportunity to show their effect upon the grass crops.

Mangel wurzels and sugar beets: About three and one-half acres of land was devoted to root crops, including, (*a*) comparative test of varieties of mangel wurzels; (*b*) comparative test of varieties of sugar beets; (*c*) continuation of experiment on soil exhaustion; (*d*) planting of sugar beets in rows at varying distances, to determine the possibilities of an acre in sugar production and the comparative cost of production under the different conditions of planting. Seeds were sent to a few farmers in the State to grow samples upon different soils, with a view of ascertaining whether the soils of the State are adapted to sugar beet growing or not.

The experiments with oats, corn and beets will be reported in future bulletins.

Alfalfa: During the growing season a third unsuccessful attempt was made on the farm at Columbus to get a set of alfalfa by seeding the ground with oats and alfalfa together.

Japan Clover—Lespedeza striata: Japan clover seed was sown in the growing corn in Wayne county, in the month of July. Some of it grew, but not enough to make a fair stand.

Indian mallow: One-fourth acre of Indian mallow (*Abutilon avicennæ*) was successfully grown for the use of the Agricultural Department at Washington.

Dairy: During the first four months of the year considerable time was devoted to the duplication of the feeding experiment conducted the two winters preceding. The plan of the experiment was extended in some directions to bring out some points more prominently. Sixteen cows were included in this trial, one-half of which were grade cows and the other half registered Jerseys. The results will be published in a future bulletin.

The State dairy test conducted by the State Board of Agriculture in coöperation with this station has occupied a small portion of my time. It has been my duty to witness the milking at the home of each cow tested, to take the sample for analysis, and deliver the same to the Station analyst.

During the year I have attended and taken part in twenty-one farmers' institutes, where I have endeavored to place before the farmers of the State the more valuable object lessons brought out by experiments on the Station farm. I have given considerable time to laying out and platting parts of the farm near Wooster. In all the work of the year I desire to acknowledge the valuable assistance and hearty coöperation of Mr. William Holmes and Mr. C. A. Patton. Both have been conscientious and interested workers.

J. FREMONT HICKMAN, *Agriculturist.*

REPORT OF THE HORTICULTURIST.

The work of the horticultural department during the year may be classified as follows:

I. Experiments with fruits.
II. Experiments in vegetable culture under glass.
III. Experiments in vegetable culture out of doors.
IV. Experiments with insecticides and fungicides.

The season was favorable for small fruits, especially for strawberries. A detailed report of the varieties tested will be given in a future bulletin, of which the following is a summary:

Strawberries.—(1.) Considerable advance has been made within the last five years in the origination of prolific perfect flowered varieties, to serve as pollenizers. The best of this class are, Lovett, Muskingum, Enhance, Parker Earle and Beder Wood.

(2.) The best of the newer imperfect flowered varieties are, Greenville, Barton's Eclipse and Shuster.

(3.) Those most suitable for home use, because of high quality, are Brunette and Farnsworth.

(4.) Because of firmness, Van Deman and Stayman may prove valuable for long shipment, but are deficient in size.

(5.) The following have not proved satisfactory here: Dayton, Michel's Early, Oregon Everbearing, Gen. Putnam.

(6.) Saunders, Gov. Hoard, Martha and Huntsman have good qualities, but no very marked characteristics, and are not likely to become general favorites.

(7.) The most reliable of the old varieties are, Haverland, Crescent Bubach and Warfield.

Raspberries.—(1.) The most promising red raspberries of recent introduction are, Royal Church, a large late sort of excellent quality, and the Thompson, a very early variety of medium size.

(2.) The Eureka, also called Mohler, is a promising blackcap, equal in size to the Gregg and nearly as early as Palmer. Kansas is similar to the Eureka, but several days later. The above appear to be acquisitions of great value, and will be more fully described in a future bulletin.

(3.) Palmer, Hilborn, Ohio, Gregg, Turner, Cuthbert, Shaffer and Muskingum still retain their place among the well tested standard sorts.

Blackberries.—The Eldorado is the most promising of the newer hardy blackberries. It appears to be as hardy as Snyder and is rather larger and of better quality. Snyder, Ancient Briton and Eldorado are the only perfectly hardy sorts in central Ohio. Erie and Minnewaski are larger than any of the above but less hardy, and are suited only to sections where the climate is comparatively mild.

Gooseberries.—The most promising of the newly introduced gooseberries are, Portage, Puyallup Mammoth and Pearl. The first and second attain size of nearly an inch in diameter, and are much alike. Pearl is smaller, but is extremly productive and gives promise of being valuable for market. The Industry is not satisfactory in all localities, because of its tendency to mildew, but this is easily overcome by the use of fungicides. The Downing is the most valuable of the old varieties.

Strawberries, raspberries, blackberries and gooseberries are the only fruits to be treated in the forthcoming bulletin above mentioned.

Garden Vegetables.—Considerable attention has been given to growing vegetables under glass. Two greenhouses, each 20 x 100 feet, heated by hot water, have been used for the purpose. The details of the results obtained thus far are given in Bulletin 43, September, 1892, of which a summary is given in the report of the Director.

Comparatively little work was done in out door vegetable culture, as most of the crops planted were for experiments in spraying, or in special methods of culture.

The most noteworthy of the latter was an experiment in pruning and training tomatoes, the results of which are not ready for final report, as another season is required in which to perfect the plan adopted. The plan consists simply in training the plants to a single stem and in tying to a trellis of an improved form. The plan is not new, except in some details, but the end sought was to determine to what extent pruning induces early ripening. The results indicate that from one to two weeks may be gained by this method, over the plan ordinarily practiced. The tomatoes are also larger and freer from rot.

The bed method of growing celery and onions by transplanting has been given attention, as well as the nomenclature of the varieties of these vegetables, and will be reported upon in due time.

Experiments with Insecticides and Fungicides.—For the purpose of corroboration, much of the work done in previous seasons was repeated, but new features were also introduced and new facts learned. The following is a summary of the results obtained:

(1.) The dilute Bordeaux mixture, which is composed of four pounds of sulphate of copper, four pounds of quicklime and fifty gallons of water, has again proved to be the best general purpose fungicide, also the best vehicle in which to use arsenical poisons for the destruction of foliage-eating insects. A too persistent and prolonged use of it must be avoided, however, as, if applied late, it may stick to the fruit until after it is ripe, and upon apples and pears it causes a russet appearance.

(2.) The copper arsenic solution, made by dissolving six ounces copper carbonate and four ounces of Paris green in two quarts of ammonia, to which are added fifty gallons of lime water, is an excellent combined fungicide and insecticide, and is probably the best of any for pears.

(3.) The early dropping of apples, which has been charged to wet weather at the time of blooming, was largely prevented the past season by early spraying with the Bordeaux mixture. A fair crop was secured from the sprayed trees, but none at all from the unsprayed.

(4.) It has been fully demonstrated that premature leaf dropping of plum trees may be prevented by the use of the Bordeaux mixture, and that when Paris green or London purple is used for curculio, it is necessary to use the Bordeaux mixture as a vehicle for conveying the poison.

(5.) Some results obtained last season indicate that Bordeaux mixture of two or three times the above strength is better for the first and second applications on grapes than the dilute mixture.

(6.) The use of Paris green, either alone or in combination with Bordeaux mixture, has not been attended with success on peach trees and American varieties of plums, because of the harm done to the foliage.

(7.) Some preliminary experiments in spraying peas show that the mildew can easily be prevented, and the crop greatly benefitted by the treatment.

(8.) The potato scab was almost wholly prevented by soaking the seed before planting, one hour in dilute Bordeaux mixture. No benefit was derived from the treatment, however, when the potatoes were planted on soil where a potato crop had been grown the previous season.

(9.) The potato blight has usually been largely prevented by applications of Bordeaux mixture to the tops, but last season but little effect was produced by the treatment, owing perhaps to the fact that the blight was less severe than usual.

A future bulletin will treat of various topics connected with spraying. It will give not only the results of recent experiments, but also directions for the treatment of some of the most common fungous diseases, and the best methods of combating insects and diseases in common.

W. J. GREEN,
Horticulturist.

REPORT OF THE ENTOMOLOGIST.

Up to July 1, 1892, the arrangement between the United States Department of Agriculture and the Experiment Station, as set forth in my preceding report, remained in force, after which date it was annulled by the Department, owing to a lack of funds. In March I was notified of the probability of a two month's furlough without pay, and although this was withdrawn later, it was followed by instructions to hold myself in readiness to spend some time on the Pacific coast. In view of these uncertainties, some investigations requiring continuous personal attention, and which would have been rendered valueless by my absence, were not undertaken. The removal, in June, from Columbus to the new location of the Station at Wooster, and the necessary delay in securing proper quarters for my laboratory work, still further interrupted many investigations, and, in fact, some were temporarily abandoned.

During the months of February and March, considerable time was spent in experimenting with insect and fungous parasites of greenhouse pests, with a view of turning them to practical use. Of the Hymenopterous parasites reared, one was *Encyrtus flavus* Howard, a parasitic of that universal pest of the conservatory, the Soft Brown Scale, *Lecanium hesperidum*. This parasite had not heretofore been observed except in California. It proved very efficient in destroying this scale, which was, at the time, destructively abundant on roses. Another parasite species, *Aphelinus mali*, was reared, the female of which was described in 1851, but the male remained unknown until I reared both sexes from *Myzus mahaleb*. The most useful parasite on Aphids was *Aphidius phorodontis* Ashm., though it exercised little or no influence in holding in check other species like *Siphonophora avenæ*, and a large green species affecting lettuce. A totally unexpected enemy of the *Myzus* was found in the much abused slug, *Limax campestris* Binney. These slugs not only left the succulent, growing lettuce, of which they are known to be very fond, but climbed up wheat and other plants to the height of ten inches and fed upon the Aphids thickly clustered on the leaves. In all of these parasites, and also in the *Empusa aphidis*, we did not find a reliable check on the Aphides. It must be stated, however, that the temperature was not under my control, and the heating was not properly attended to, causing those frequent and radical changes in temperature so adverse to the development of parasites. while offering little if any obstacle to the increase of the Aphides. Later, and in the fields, a Syrphus fly, *Paragus tibialis*, was found parasitic on *Aphis rumicis*. An aphis of the squash, *Siphonophora cucurbitæ*, was carried through its entire cycle on *Capsella bursa pastoris* and *Nepeta glechoma*, males, oviparus and viviparus females and eggs being secured. This matter was published in the Canadian Entomologist, vol. XXIV, p. 311.

Considerable time was spent in the study of wheat insects. An outbreak of a species of wire worm, *Melanotus communis*, which destroyed about ten per cent. of the plants over a portion of one field, was investigated and the results published in Bulletin No. 46. The larvæ of a species of Saw Fly, probably *Dolerus arvensis*, as the adults were observed ovipositing in the field in early spring, were observed in considerable abundance in some of the Station fields. Three insect enemies of growing wheat, new, so far as any published record is concerned, were reared from the plants. These are all small flies much resembling *Oscinis variabilis* (?), an illustrated notice of which appeared in the bulletin of this Station for April, 1892, p. 81. Two of the new ones are Frit flies and are *Oscinis umbrosa* and *O. coxendix*, the latter of which was described by Dr. Fitch as occurring about wheat fields, but nothing has up to this time been learned of its habits. In this case these were, both of them, reared from the injured wheat plants. Their injuries closely resemble those of *Oscinis variabilis* (?). The third species is similar to these but undetermined. A new parasite on the last named species was reared and will be described in a bulletin of the technical series, now nearly ready for the printer. Two other rearings were of special interest from both an economical and technical standpoint. These were both species of *Diplosis*, probably undescribed, and very closely allied to the Wheat Midge, *Diplosis tritici*, but are, in this case, friends instead of enemies. The larvæ of one were engaged in destroying the cherry Aphis, *Myzus cerasi*, in Fulton county, and the other was engaged in destroying the cabbage Aphis *A. brassicæ*, at Columbus, Ohio. Instances of the carniverous habits of members of this genus, though not unknown, are not of common occurrence.

An injury to growing wheat in June, about Wooster, has been investigated. This consists of an attack by the old and long known joint worm, *Isosoma hordei*, though this is supposed to form galls or swellings usually below the upper joint of the straw, while in this case they were invariably situated above it. An entirely new species and for which it has become necessary to erect a new genus of Hymenoptera, was reared from these galls in considerable numbers, and it is likely that the species will prove to be a very useful parasite. This also will be described in the forthcoming technical bulletin.

A large number of other investigations have been carried on and the results have either been recorded in the regular bulletins, or else they have not yet sufficiently developed to demand mention here.

Of the outbreaks of injurious insects over the state there are a number which may be especially mentioned. The appearance of the clover leaf Weevil, *Phytonomus punctatus*, in the Western Reserve and also in small numbers in the vicinity of Cincinnati, may be noted as the first occurrence of the pest in Ohio. The western corn root worm, *Diabrotica longicornis*, was also reported in destructive numbers in Hamilton county. This is, so far as I am aware, the first appearance of this pest in Ohio, and I would call attention to the probability of its slowly working its way eastward. A curious outbreak of a species of horse and cattle fly, *Tabanus abdominalis*, in Hamilton county was reported by Mr. R. H. Warder, of the Board of Control of this Station. These flies made their appearance in Mr. Warder's neighborhood in August, in enormous numbers, and attacked stock, following cattle and horses like a swarm of bumble bees, as Mr. Warder expresses it, and biting the cattle until they became fairly raw on the neck from the attacks and their attempts to rid themselves of their tormentors. The scourge continued about two weeks.

In conclusion, I wish to call attention to the necessity of placing a certain fund at the disposal of the Entomologist to cover traveling expenses and cost of field experiments, at a distance from the Station. This will enable him to promptly visit the locality of an outbreak of any insect and to aid and assist in the application of means of repression or prevention. No reputable physician will consent to treat his patients by mail, yet the Entomologist is compelled to do a precisely similar thing, and, it is expected, that his advice will be of such a nature as to enable people to stop or prevent the ravages of insect pests in orchard and field. This is simply an impossibility in many cases. Some insects can be handled under instructions transmitted by mail, but there are many of which there is much to be learned in the matter of habits and remedial measures, and with a reasonable expense fund at his disposal the Entomologist would be in a position to save the people dollars where now he saves them dimes.

Without wishing to be egotistical in the least, the present incumbent of this office can furnish published proof that the expenditure of a few dollars and a few days' time resulted in the saving of $10,000 in a single year and that too, to a single, very extensive farmer of an adjoining state, the amount being estimated by the farmer himself.

F. M. WEBSTER,
Entomologist.

REPORT OF THE BOTANIST.

Having resigned my position at the Station before the close of the summer season, and being occupied during the latter part of that season in closing up the work, arranging the herbarium, preparing material for the Columbian Exhibition, etc., there was not much time for original investigation.

However, the lines of work laid down the previous year were followed as far as possible; various fungous diseases, especially apple scab and the diseases affecting the raspberry and blackberry, were carefully watched, but no additional reports were made. A brief report was published on *Septoria consimilis,* the leaf-spot disease of lettuce. Until last spring this disease was not noticed on cultivated lettuce in the Station gardens. The source of infection can be directly traced to the prickly lettuce, *Lactuca scariola*, as the fungus was very abundant on this very abundant weed. It is an interesting point, that in looking over the available station bulletins of all the states, I have found no report of this fungus on the cultivated lettuce.

Specimens of *Septoria consimilis*, *Cercospora apii*, *Cercospora beticola* and *Bremia lactucæ* were furnished for the Columbian Exhibition.

A preliminary list of the rusts of Ohio has been published, and, an article on *Empusa aphidis* will appear in a future bulletin.

FREDA DETMERS, *Botanist.*

REPORT OF THE CHEMIST.

The work of this department has been confined mainly to the analysis of milk and feeding stuffs in connection with the feeding experiment conducted by the Station during the winter of 1891–1892. This work is not yet ready for publication.

Analyses were made of sugar beets, published in Bulletin No. 2, p. 23. Determinations of crude protein in wheat were made in connection with the field experiments with fertilizers on wheat, and were published in Bulletin No. 5, pp. 90–91.

Eleven analyses of milk were made during the year for the Ohio State Board of Agriculture in connection with the premiums offered by that Board, to be given at the Ohio State Fair.

Complete analyses of sixteen samples of soil were made from the field hitherto used in experiments with fertilizers on wheat, the results of which will be published later.

Some work was done determining phosphoric acid in fertilizers for the Association of Official Agricultural Chemists.

The following determinations of sugar in sugar beets were made for parties residing in various sections of the state, the object being to ascertain whether the culture of beets for sugar can be made profitable in Ohio. Thus far, only those raised in the northern part of the state have shown a sufficient percentage of sugar to justify their culture for this purpose.

DETERMINATION OF SUGAR IN BEETS RAISED IN OHIO.

Variety.	Date of planting.	Date of harvesting.	Sugar in beet—per cent.	Grown by	Post-office address.	County.
White Sugar Beet	July 2	Oct. 15	7.40	Esther Martz	Greenville	Darke.
Lane's Imperial	July 2	Oct. 15	6.46	“	“	“
Vilmorin's Improved	July 2	Oct. 15	9.46	“	“	“
Klein Wanzleben	April 27	Oct. 14	12.65	Exper. Station	Columbus	Franklin.
Wohanka	April 27	Oct. 14	9.06	“	“	“
Yellow Oberndorf	April 27	Oct. 14.	8.75	“	“	“
Red-top Sugar	June 24	Oct. 1	8.66	J. J. Reames	West Middleburg	Logan.
Red-top Sugar	June 24	Oct. 1	7.83	“	“ “	“
Red-top Sugar	June 24	Oct. 1	10.26	“	“ “	“
Golden Giant	May 3	Oct. 20	5.01	Exper. Station	Wooster	Wayne.
White Sugar Silesian	May 3	Oct. 20	6.81	“	“	“
Breck's Imperial	May 3	Oct. 20	5.65	“	“	“
Golden Tankard	May 3	Oct. 20	6.17	“	“	“
Klein Wanzleben	June 1	Oct. 25	10.73	D. D. Benedict	Norwalk	Huron.
Klein Wanzleben	June 1	Oct. 25	12.40	“	“	“
Vilmorin	Early April	Last of Oct.	6.49	“	“	“
Vilmorin	May 12	Oct. 10	7.66	“	“	“
White Sugar	May 30	Oct. 10	8.47	Thos. A. Johnson	Rushylvania	Logan.
White Sugar	May 30	Oct. 10	7.86	“	“	“
Lane's Imperial	May 30	Oct. 10	12.54	“	“	“
Klein Wanzleben	May 9	Nov. 12	14.21	J. A. Nicholls	Norwalk	Huron.
Vilmorin	May 9	Nov. 12	13.58	“	“	“
Klein Wanzleben	June 3	Oct. 25	13.66	S. J. Rogers	“	“
Vilmorin	June 3	Oct. 25	14.03	“	“	“

Owing to the removal of the station it became necessary to equip a new laboratory in Wooster, which has involved considerable interruption to my work during the latter part of the year.

F. J. FALKENBACH,
Chemist.

APPENDIX.

BULLETIN

OF THE

OHIO AGRICULTURAL EXPERIMENT STATION.

VOL. V. SECOND SERIES. 1891.

CONTENTS.

	Page.
Experiments with oats	3
Mangel wurzels and sugar beets	17
Field experiments with commercial fertilizers	35
Insects which burrow in the stem of wheat	59
Field experiments with wheat	83
Greenhouses and greenhouse work	99
Tomatoes as a greenhouse crop	106
Lettuce as a greenhouse crop	108
The food of the robin	115
A preliminary list of the rusts of Ohio	133
Wild lettuce—a pestiferous weed	141
Wheat scab	147
Insects affecting the blackberry and raspberry	151
Underground destroyers of the wheat plant	221
Meteorological summary for 1892	249

BULLETIN

OF THE

OHIO AGRICULTURAL EXPERIMENT STATION.

VOL. V, No. 10. SECOND SERIES. DECEMBER,
Whole Number 47. 1892.

METEOROLOGICAL SUMMARY FOR 1892.

EXPLANATION OF TABLES.

The following tables contain statistics of temperature, rainfall, etc., for the year, and are compiled from data obtained by daily observations, made at 7 a. m., 2 p. m. and 9 p. m. T stands for "trace," less than 0.01 inch of daily rainfall. Temperature is given in degrees, Fahrenheit.

Table I shows the daily rainfall at the station during the year in inches and hundredths.

Table II shows the daily mean temperature for 1892, and the normal mean temperature for each day, computed from ten years' record.

Table III gives a comparison of the monthly mean temperature, humidity and rainfall for the station and the state, with the ten-year averages for the same.

Table IV shows the rainfall at the station for each month during the last ten years.

Table V contains the record of atmospheric pressure; the mean temperature; the highest and lowest temperature, with the range of temperature for each month; the number of clear, fair, cloudy and rainy days; the rainfall and prevailing direction of wind for both the Experiment Station and state.

Table VI contains the principal points of interest on the temperature, state of weather, and rainfall during the same period, and a grand summary for ten years.

I am indebted to the Ohio State Meteorological Bureau for the daily normal temperatures in table II, and for the statistics on the weather of the state.

METEOROLOGY—TABLE 1.

Daily Rainfall and Melted Snow for 1892—At Experiment Station.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.13		.03		T	.81		1.20			.36	
2	.16	.19		.55	.43	.15	.16	.13			.22	
3	.02			.61	.16	T	1.22			T	.01	
4	.10	T	T	T	.23	.06		1.60				
5	T	.45	.47	.31		T			.18		.04	
6	.30				.02							0.60
7	T	.38				05				T	.07	0.16
8	.10		.12	.08		1.91				.32		T
9			.13	.12		.21					.27	
10	T	T	.08	T	.25			T		T		
11	T	.12	.02		.01		T	2.05				
12	09	.05			T				.08			
13	66				.15		.19		.77			.59
14	.14	.75	.02	.35	.33	.05	T				.57	T
15				,02	.59	.42	.10					T
16		T							.05	T		
17			.05	T		.09						T
18	.30	.07	.02	.09	.79	.60					.48	
19	.05	.76	.05		.47	1.24	.68	.10		.33	.39	
20		.01		.30	.41	T				.02		
21				.10		.57						
22		T	.26	.02	T	.03	.13		T			
23			.28		.07	.13						0.01
24												0.03
25		.01			.15			.03	.19			0.08
26		T	T		.41		.17	.25			.02	
27			.16		T	T		.55			.16	
28		T		.08	.06						.03	
29		.48			.10	.26	.48					
30	T		.47			.15		.24				
31							T					0.38
Total	2.05	3 27	2.16	2.63	4.63	6.73	3.13	6.15	1.27	0.67	2.62	1.85
Average	.07	.12	.07	.09	.15	.22	.10	.20	.04	.02	.09	.06

METEOROLOGY—TABLE II.

DAILY MEAN TEMPERATURE FOR 1892.—AT EXPERIMENT STATION.

N stands for Normal Mean Temperature for 10 years.)

	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.	1892.	N.
1	50	35	40	28	30	30	63	46	71	49	74	64	62	72	68	74	57	62	62	60	55	48	28	31
2	24	21	39	33	26	31	62	46	67	57	70	65	69	72	68	73	59	66	53	58	57	47	37	31
3	18	21	34	34	31	30	60	44	67	59	68	66	61	72	73	71	68	67	70	57	50	44	38	34
4	25	27	31	32	45	28	71	46	66	61	71	67	68	72	66	70	73	68	58	55	42	43	36	31
5	22	28	19	28	35	27	67	44	71	59	72	68	68	72	67	70	65	67	42	54	31	44	34	34
6	21	26	22	28	33	32	47	42	65	59	75	69	69	74	75	70	56	66	45	53	44	44	50	36
7	14	23	48	35	42	32	50	45	52	56	69	68	69	74	77	70	64	68	58	54	55	47	56	36
8	24	27	33	32	42	31	42	43	48	59	68	69	72	72	78	72	66	66	46	52	34	46	35	36
9	8	23	28	29	38	34	30	44	61	62	69	70	70	71	82	74	72	68	48	52	32	48	32	35
10	14	23	34	31	18	32	34	48	62	63	69	68	72	71	77	72	72	66	50	54	28	44	29	36
11	32	26	26	31	24	37	34	49	51	59	74	68	74	72	74	71	74	66	52	54	35	44	23	35
12	28	27	14	28	42	37	37	50	48	60	78	70	77	74	68	72	67	67	51	55	36	40	28	33
13	26	27	29	31	29	34	44	50	57	60	80	71	74	72	66	70	62	65	56	55	45	40	42	36
14	16	25	38	34	22	35	39	53	65	59	76	72	75	73	66	70	56	62	54	51	46	38	38	36
15	10	26	25	32	24	34	39	52	64	60	76	74	78	73	69	70	57	65	65	49	41	38	33	31
16	12	27	22	34	28	35	45	50	60	56	82	75	62	73	74	71	60	65	66	49	45	40	34	31
17	26	25	29	36	23	35	49	54	65	60	78	76	66	74	74	72	58	62	56	54	53	40	35	30
18	26	22	38	33	22	39	45	52	66	64	75	74	69	72	75	71	64	64	67	53	37	37	32	29
19	9	21	43	33	26	37	44	54	54	61	72	73	73	70	70	71	66	64	52	52	29	34	32	27
20	7	26	38	29	30	33	46	55	53	60	75	71	72	70	74	72	66	62	50	46	28	37	21	29
21	17	19	40	28	32	32	57	56	52	60	75	72	76	72	73	73	65	61	51	46	30	39	22	32
22	30	23	44	30	46	34	49	54	48	62	76	71	78	75	71	69	70	63	53	45	27	40	19	30
23	27	28	42	30	34	34	54	55	52	62	80	71	83	75	73	68	70	61	45	45	22	38	20	34
24	34	26	47	38	37	40	44	50	59	58	78	72	86	74	71	65	71	61	40	44	25	36	12	33
25	34	28	40	36	48	43	47	51	62	62	69	69	82	74	74	66	71	62	38	45	30	35	14	31
26	11	24	38	31	50	43	52	54	52	60	69	71	79	74	68	68	56	61	42	46	32	36	12	28
27	13	27	39	29	40	42	67	58	53	60	67	69	81	75	68	68	53	59	43	47	34	35	17	27
28	32	28	44	29	38	38	59	55	60	61	68	72	82	74	69	64	58	60	53	44	34	30	20	27
29	38	30	37	28	43	38	50	54	65	62	70	69	78	74	74	68	62	59	41	45	34	30	16	29
30	32	30	...	...	49	42	56	56	69	61	67	71	72	75	69	66	63	60	37	42	33	30	21	30
31	32	31	...	...	52	44	...	...	76	63	...	...	74	76	59	64	...	...	50	45	...	...	31	36
Daily mean temperature.	23	26	35	31	35	35	50	50	60	60	73	70	73	73	71	70	63	64	52	50	37	40	29	32

METEOROLOGY—TABLE III.

COMPARISON OF MEAN TEMPERATURE MEAN RELATIVE HUMIDITY AND RAINFALL FOR 1892.

	Jan.	Feb.	March	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mean temperature at the station	28°	35°	35°	50°	60°	73°	78°	71°	63°	52°	37°	29°	51°
Ten-year average temperature at the station	26°	31°	35°	50°	60°	70°	78°	70°	64°	50°	40°	32°	50°
Mean relative humidity at the station (per cent.)	80	80	74	68	77	82	76	79	80	74	82	83	78
Ten-year average relative humidity at the station (per cent.)	87	85	80	74	77	79	76	78	78	79	82	83	80
Mean temperature for the state	24°	35°	35°	49°	59°	73°	73°	71°	64°	52°	38°	29°	51°
Ten-year average temperature for the state	27°	31°	35°	50°	60°	69°	78°	70°	64°	51°	41°	33°	50°
Mean relative humidity for the state (per cent.)	83	84	82	74	80	79	78	78	78	76	87	84	80
Ten-year average humidity for the state (per cent.)	83	82	79	73	75	77	74	75	77	75	80	81	78

	Inches.	nches.	Inches.	Inches.	Inches.	Inches	Inches.	Inches.	Inches.	Inches	Inches.	Inches.	Inches.
Rainfall at the station	2.05	3.27	2.16	2 63	4.63	6.73	3.13	6.15	1 27	0.67	2.62	1.85	37.16
Ten-year average at the station	3.02	5.06	4 26	2.08	3.05	4 12	4.28	2.27	1 17	2 59	5.43	2.42	39 75
Mean rainfall for the state	2.11	3 03	2 86	3.32	6.32	5.61	3.80	2.99	2.36	0.73	2.32	1.71	37 16
Ten-year average for the state	3.29	3.85	2.92	2 76	4 27	4.13	3.46	3.30	3 03	2 46	3.14	2.27	38 88

METEOROLOGY—TABLE IV.

MONTHLY RAINFALL FOR TEN YEARS.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1883	2.90	5.81	2.87	2.98	5.76	4.70	2.92	2.12	3.13	4.34	3.87	4.97	46.37
1884	2.77	5.29	4.10	2.40	4.34	1.11	2.23	0.45	4.23	1.49	1.13	3.87	33.41
1885	4.03	3.17	0.98	4.51	5.92	4.84	3.01	5.50	2.00	3.12	2.89	1.68	41.65
1886	4.49	1.67	2.83	3.25	6.91	2.23	3.01	1.42	3.42	1.19	4.18	3.41	38.01
1887	1.54	6.85	2.84	4.45	4.36	5.47	1.56	2.47	1.82	0.38	2.64	2.04	36.62
1888	4.04	1.71	4.33	2.39	6.67	2.43	4.72	5.85	1.26	5.14	4.30	1.36	44.20
1889	3.90	0.81	1.00	1.11	3.46	2.08	2.85	2.07	3.77	1.79	3.72	2.24	28.80
1890	5.50	5.88	4.88	4.08	4.69	5.43	1.41	3.71	8.16	2.71	1.76	2.38	50.59
1891	3.13	5.26	4.38	2.02	2.87	3.83	4.41	1.84	1.16	2.80	5.74	2.42	39.86
1892	2.05	3.27	2.16	2.63	4.63	6.73	3.13	6.15	1.27	0.67	2.62	1.85	37.16
Average	3.53	3.88	3.05	2.97	4.96	3.89	2.90	3.15	3.19	2.36	3.11	3.09	39.67

METEOROLOGY—TABLE V.—SUMMARY BY MONTHS FOR 1892.

	Barometer.						Mean relative humidity.			
	Mean.	Highest.	Date.	Lowest.	Date.	Range.		Mean.	Highest.	Date.
At the Experimeut Station.										
January	30.16	30.64	16th.	29.55	1st.	1.11	80	23	55	1st
February	30 12	30 68	16th.	29.39	14th.	1.29	80	35	62	24th.
March	30.08	30.52	[*1]	29.37	8th.	1.15	74	35	65	26th.
April	30.08	30.45	25th.	29,68	11th.	0.77	68	50	78	[*3]
May	29.95	30.29	8th.	29.55	19th.	0.74	77	60	86	31st
June	29.93	30.10	13th.	29.60	27th.	0.50	82	73	92	16th.
July	30.07	30.45	7th.	29.77	3d.	0.68	76	73	95	24th.
August	30 03	30.16	16th.	29.75	24th.	0.41	79	71	90	[*8]
September	30.11	30.37	2d.	29.41	13th.	0.96	80	63	86	10th.
October	30.10	30.44	30th.	29.61	7th.	0.83	74	52	83	[*11]
November	30.12	30.48	22d.	29.39	17th.	1.09	82	37	69	17th.
December	30.16	30.61	11th.	29.53	7th.	1.08	83	29	64	7th.
Sums and averages	30 02	30.68	Feb. 16.	29.37	Mar. 8.	0.88	78	50	95	July 24
For the State.										
January	30.13	30.70	16th.	29.37	6th.	1.33	83	24	61	1st.
February	30.13	30.78	17th.	29.31	11th.	1.47	84	35	74	23d.
March	30.09	30 59	21st.	29.31	8th.	1.28	82	35	80	31st.
April	30.07	30.54	25th.	29.64	[*5]	0.90	74	49	90	[*6]
May	29 97	30.47	8th.	29.38	19th.	1.09	80	59	99	31st.
June	29 96	30.18	[*7]	29.50	27th.	0.68	79	73	101	17th.
July	30.08	30.51	7th.	29.71	3d.	0 80	78	73	103	25th.
August	30 02	30.22	16th.	29.69	24th.	0.53	78	71	99	16th
September	30.13	30.39	30th.	29.37	13th.	1.02	78	64	96	9th.
October	30 08	30.52	30th	29.40	28th.	1.12	76	52	89	3d.
November	30 09	30.60	8th.	29.28	17th.	1.42	87	38	76	2d.
December	30 15	30.71	11th.	29.40	[*11]	1.31	84	29	70	[*12]
Sums and averages	30.08	30.78	Feb. 17.	29.31	Feb. 11. Mar. 8.	1.08	78	50	103	July 25.

Station—[*1] March 14th and 21st. [*2] March 10th, 11th and 14th. [*3] April 1st and 5th. [*8] August 8th and 9th. [*9] August 1st and 9th. [*10] Sept. 13th and 21st. [*11] October 1st, 3d

State—[*1] January 13th, 19th, 23d and 26th. [*2] February 5th and 6th. [*3] February 3d, 12th and 25th. [*8] October 1st and 9th. [*9] October 8th, 25th and 29th. [*10] November 3d, 12th and

METEOROLOGY—TABLE V.—SUMMARY BY MONTHS FOR 1892.

Temperature.								No. of days						
Lowest.	Date.	Range.	Mean daily range.	Greatest daily range.	Date.	Least daily range.	Date.	Clear.	Fair.	Cloudy.	Rain fell.	Monthly rainfall.	Average daily rainfall.	Prevailing wind.
–18	20th.	73	17	34	20th.	5	5th.	9	12	10	11	2 05	.07	S.W.
0	6th.	62	17	37	6th.	4	3d.	6	8	15	11	3.27	.12	S.
13	*2	52	18	35	25th.	7	18th.	9	11	11	14	2.16	.07	N.
22	9th.	56	21	36	1st.	10	*4	8	13	9	12	2.63	.09	N.E.
35	8th.	51	20	32	*5	10	*6	8	12	11	17	4.63	.15	S.
54	26th.	38	19	28	13th.	10	18th.	5	21	4	16	6.73	.22	S.
47	2d.	48	21	30	*7	5	30th.	9	20	2	8	3.13	.10	S.W.
48	31st.	42	22	32	16th.	11	*9	9	20	2	9	6.15	.20	N.
34	27th.	52	27	40	3d.	12	*10	17	11	2	5	1.27	.04	S.W.
22	30th.	51	29	44	*12	11	25th.	14	13	4	3	0.67	.02	N.W.
8	20th.	61	16	34	13th.	5	28th.	9	13	8	12	2.62	.09	N.W.
0	26th.	64	14	29	2d.	4	14th.	5	16	10	7	1.85	.06	W.
– 18	Jan. 20.	113	20	44	*12	4	Feb. 3. Dec. 14.	108	170	88	125	37.16	.10	S.
—25	20th.	86	16	47	19th.	3	*1	9	9	13	11	2.11	.07	S W.
–1	*2	71	16	43	5th.	2	*3	5	8	16	11	3.03	.10	S.
6	*4	74	17	43	25th.	2	23d.	7	11	13	13	2.86	.09	N.W.
14	19th.	76	21	50	1st.	2	18th.	8	11	11	10	3.32	.11	N.W.
28	8th.	71	20	47	8th.	2	19th.	6	11	14	17	6.32	.21	S.W.
47	29th.	54	20	39	13th.	3	3d.	9	13	8	15	5.61	.19	S.W.
40	17th.	63	22	46	7th.	1	29th.	15	12	4	8	3.80	.12	S.W.
45	29th.	54	21	41	31st.	3	5th.	15	11	5	7	2.99	.10	S.W.
34	27th.	62	24	51	25th.	3	5th.	16	10	4	6	2.36	.08	S.W.
20	30th.	69	23	48	*8	2	*9	12	11	8	5	0.73	.02	N.W.
8	11th.	68	15	48	5th.	1	*10	4	10	16	11	2.32	.08	N W.
—12	28th.	82	15	39	9th.	1	17th.	5	9	17	7	1 71	.06	W.
—25	Jan. 20t	128	19	51	Sept. 25.	1	July 29, Nov. 3, 12, 28. Dec 12,	111	126	129	121	37.16	.10	S W.

*4 Apriil 8th and 20th. *5 May 1st and 9th. *6 May 4th and 19th. *7 July 2nd and 27th.
and 8th. *12 October 14th and 18th.
and 20th. *4 March 11th and 14th. *5 April 4th and 5th. *6 April 4th and 5th. *7 June 11th
28th. *11 December 7th, 8th, *12 Dec., 11th and 12th.

METEOROLOGY.—TABLE VI.—SUMMARY BY YEARS AND GRAND SUMMARY FOR TEN YEARS.—*Part First.*

	1883.	1884.	1885.	1886.	1887.
At the Experiment Station					
Mean relative humidity	82.3 per cent	82.3 per cent	84.2 per cent	82.7 per cent	79 2 per cent.
Mean temperature	49.1°	50 1°	47.4°	49.2°	50.8°.
Highest temperature	97.0°, August 22	97.0°, August 20	101.0°, July 21	97.5°, June 4	102.5°, July 17.
Lowest temperature	—7.0°, January 12	—32.0°, January 25	—20.0°, Feb. 21	—12.0°, Feb. 17	—10.0°, Jan. 11.
Range of temperature	104.4°	129.0°	121 0°	109 5°	112.5°.
Mean daily range of temperature	22.9°	24.8	23.1°	23.6°	21.1°.
Greatest daily range of temperature	45°, September 11	49.5°, July 22	55.0°, Feb. 2	48.0°, Feb. 17	47.5°, Sept. 5.
Least daily range of temperature	1. 8° January 28	4.0°, Feb. 22	4.0°, Dec. 10	5.0°, Feb. 7	3 0°, Dec. 12.
Number of clear days	105	103	83	107	98
Number of fair days	147	119	137	145	130.
Number of cloudy days	113	144	145	113	137.
Number of days rain fell	165	149	166	154	158.
Total rainfall	46.37 inches	33.41 inches	41.65 inches	38.01 inches	36 62 inches.
Mean daily rainfall	0.127 inch	0.091 inch	0.114 inch	0.104 inch	0.100 inch.
Greatest monthly rainfall	5.81 inches, Feb	5.29 inches, Feb	5.92 inches, May	6.91 inches, May	6.85 inches, Feb.
Least monthly rainfall	2.12 inches, Aug	0.45 inch, Aug	0 98 inch, March	1.19 inche. Oct	0.38 inch. Oct.
Warmest day of year	82.7°, July 23	80 5°, July 23	85. 8°, July 31	81.9°, July 29	87 0°, July 17.
Coldest day of year	1.0°, Jan. 22	—16 8°, Feb. 6	—4.0°, Feb. 10	—5.05°, Jan. 10	0 6° Jan. 10.
Prevailing direction of wind	N. W	S. W	S. W	S. W	S. W.
For the State.					
Mean relative humidity	76.3 per cent	76.8 per cent	77.5 per cent	77.8 per cent	75.8 per cent.
Mean temperature	49.4°	50.6°	48.0°	49.6°	51.4°.
Highest temperature	98°, August 22	99 0°, Sept. 28 and Oct. 1	101.0°, July 21	98.6°, July 7	108.0°, July 18.
Lowest temperature	—17.2° Jan. 22	—34.0°, Jan. 25	—31.0°, Jan. 29	—21.5°, Jan. 12	—21.0, Jan. 7.
Range of temperature	115.5°	133.0°	132.0°	120.1°	129.0°.
Mean daily range of temperature	19.8°	20.5	20.4	20.2°	21.2°.
Greatest daily range of temperature	55.2°, March 18	50.0°, Sept 5 and Dec. 4	58.5°, Jan. 30	57.0°, Dec. 11	57.0°, April 11.
Least daily range of temperature	0.5°, December 23	1.1°, Feb. 6	1.0°, Apr. 18 and Dec. 31	1.1°, March 27	1.0°, Jan. 15 and Apr. 16.
Average number of clear days	98.2	116.7	103.5	118.4	113.8.
Average number of fair days	135.4	118.3	132.8	125.7	127.3.
Average number of cloudy days	130.4	131.1	128.2	121.0	123.9.
Average number of days rain fell	146 0	145.0	147.7	130.7	120 9.
Mean yearly rainfall	44.98 inches	40.19 inches	38.08 inches	36 71 inches	33.63 inches.
Mean daily rainfall	0.123 inch	0.110 inch	0.104 inch	0 100 inch	0 092 inch.
Prevailing direction of wind	S. W	S. W	S. W	S. W	S. W.

METEOROLOGY—TABLE VI.—*Part Second.*

	1888.	1889.	1890.	1891.	1892.	Sum'ary for ten years.
At the Experiment Station.						
Mean relative humidity	82.8 per cent	79.8 per cent	78.5 per cent	77 per cent	78 per cent	81 per cent
Mean temperature	49.6°	51.2°	52 3°	51°	50°	50°
Highest temperature	98.0°, June 20	93.0° Aug. 31 and Sept. 1	95.0°. July 8 and 15	94°, Aug. 9 and 10	95°, July 25	102.5°, July 17, 1887
Lowest temperature	—11.0°, Jan. 28	1.0°, Feb. 23	4.0°, March 6	—2°, March 5	—18°, Jan. 20	—32°, Jan. 25, 1884
Range of temperature	109.0°	92.0°	91 0°	96°	113	134.5°
Mean daily range of temp.	21 1°	20.8°	19.1°	21°	20°	22°
Greatest daily range of temp.	43.2°, April 28	41.5°, April 23	41.0°, January 13	43°, Oct. 17	44°, Oct. 14, 18	55°, Feb. 2, 1885
Least daily range of temp.	4.1°, Aug 21	3.0°, Jan. 6 and Nov. 20	2.0°, December 17	3° Jan. 18	4°, Feb. 3, Dec. 14	1.8°, Jan. 28, 1883
Number of clear days	96	121	115	142	108	108
Number of fair days	141	113	125	119	170	135
Number of cloudy days	129	128	125	104	88	122
Number of days rain fell	142	163	163	134	125	152
Total rainfall	44.20 inches	28.80 inches	50.59 inches	39 86 inches	37 16 inches	39 67 inches
Mean daily rainfall	0.120 inch	0.079 inch	0.139 inch	0 11 inc	0.10 inch	0.11 inch
Greatest monthly rainfall	6.67 inches, May	3.90 inches in January	8.16 inches in Sept.	5.74 inches in Nov	6.73 inches, June	8.16 inches
Least monthly rainfall	1.26 inches, Sept	0.81 inches in February	1.41 inches in July	1.16 inches in Sept.	0.67 inches, October	0.38 inch in Oct., 1887.
Warmest day of year	84.1°, June 20	80.5°, July 9	86.1°, July 30	86°, Aug. 10	86°, July 24	87°, July 17, 1887
Coldest day of year	7.5° Feb. 9	4.9°, February 23	12 8°, March 6	12°, Feb. 4	7°, Jan. 20	—16.8°, Feb. 6, 1884
Prevailing direction of wind	S. W	S. W	S	S	S. W	S. W
For the State.						
Mean relative humidity	78.2 per cent	79.4 per cent	80.2 per cent	78 per cent	78 per cent	78 per cent
Mean temperature	49.5°	51.1°	52.1°	52°	50°	50°
Highest temperature	102.0°	99.5°, August 31	103.1°, August 3	101°, Aug 10	103°, July 25	108°, July 18, 1887
Lowest temperature	—15.0°, Jan. 27	—13.5°, February 24	—1°, March 7	—5°, March 5	—25°, Jan. 20	—34°, Jan. 25, 1884
Range of temperature	117°	113 0°	107.1°	106°	128°	112°
Mean daily range of temp.	19.6°	19.3°	19°	20°	19°	20°
Greatest daily range of temp.	50.0°	53.0°, March 30	49.5°, April 11	50°, April 27 and 30	51°, Sept. 25	58 5°, Jan. 30, 1885
Least daily range of temp.	1.2°, Jan 16	1.0°, January 5	1.0°, December 17	2° *	1° †	0.5°, Dec. 23, 1883
Average number of clear days	108.7	112.8	103.4	133	111	112
Average number of fair days	123.4	113 8	121.6	109	126	123
Average number cloudy days	133.9	138 4	140.3	137	129	131
Average number days rain fell	121.7	114.8	149 4	120	121	132
Mean yearly rainfall	39.64 inches	33 53 inches	50.33 inches	38.61 inches	37.16 inches	39.28 inches
Mean daily rainfall	0.108	0.092 inch	0.138 inch.	0.11 inch	0.10 inch	0.11 inch
Prevailing direction of wind	S. W	S. W	S. W	S. W	S. W	S. W

---

*January 4 and 11; March 19 and 22; November 12; and December 4.

†July 29; Nov. 3, 12, 28; Dec. 17.

NOTES ON THE WEATHER AT THE STATION.—SUMMARY BY MONTHS.

JANUARY.

The mean temperature was 23°, 3° below the station average for January. The highest temperature, 55°, occurred on the 1st; the lowest, —18°, on the 20th.

The mean relative humidity was 80 per cent. Fair weather prevailed. Rain and snow fell on eleven days. The total snowfall for the month was 12.40 inches; the total rain and melted snow, 2.05 inches, which is 1.38 inch below the station average for January. The greatest daily rainfall was .66 inch, on the 13th.

Lunar halos occurred on the 9th, 14th, and 16th.

Sleet occurred on the 12th, 13th, and 14th.

The prevailing wind was southwest.

FEBRUARY.

The mean temperature was 35°, 4° above the station average for February. The highest temperature, 62°, occurred on the 24th; the lowest, 0°, on the 6th.

The mean relative humidity was 80 per cent. Cloudy weather prevailed. Rain and snow fell on eleven days. The total snowfall for the month was 6.0 inches; the total rain and melted snow, 3.27 inches, which is .57 inch below the station average for February. The greatest rainfall in 24 hours was .76 inch on the 19th.

An aurora occurred on the 13th.

The prevailing wind was south.

MARCH.

The mean temperature was 35°, which is the station average for March. The highest temperature, 65°, occurred on the 26th; the lowest, 13°, on the 10th, 11th and 14th.

The mean relative humidity was 74 per cent. Cloudy weather on eleven days; fair weather on eleven days. Rain and snow fell on fourteen days. The total snowfall was 2.40 inches; the total rain and melted snow, 2.10 inches, which is .79 inch below the station average for March. The greatest rainfall in 24 hours was .47 inch on the 5th and 30th.

The prevailing wind was north.

APRIL.

The mean temperature was 50°, which is the station average for April. The highest temperature, 78°, occurred on the 1st and 5th; the lowest, 22°, on the 9th.

The mean relative humidity was 68 per cent. Fair weather prevailed. Rain and snow fell on twelve days. The total snowfall for the month was 1.40 inch; the total rainfall, 2.63 inches, which is 0.34 inch below the station average for April. The greatest daily rainfall was 0.61 inch on the 3d.

Thunder storms occurred on the 3d and 4th.

Lunar halos occurred on the 6th, 7th and 11th.

The prevailing wind was northeast.

MAY.

The mean temperature was 60°, which is the station average for May. The highest temperature, 86°, occurred on the 31st; the lowest, 35°, occurred on the 8th.

The mean relative humidity was 77 per cent. Fair weather prevailed. Rain fell on seventeen days. The total rainfall for the month was 4.63 inches, which is .33 inch below the station average for May. The greatest rainfall in 24 hours was 0.79 inch, on the 18th.

A light frost occurred on the 8th.

Thunder storms occurred on the 2d, 3d, 4th, 18th and 26th.

The prevailing wind was south.

JUNE.

The mean temperature was 73°, which is 3° above the station average for June. The highest temperature, 92°, occurred on the 16th; the lowest, 54°, on the 26th.

The mean relative humidity was 82 per cent. Fair weather prevailed. Rain fell on sixteen days. The total rainfall for the month was 6.73 inches, which is 2.90 inches above the station average for June. The greatest rainfall in 24 hours was 1.91 inch, on the 8th.

Thunder storms occurred on the 1st, 2d, 7th, 8th, 14th, 15th, 17th, 18th, 19th, 21st, 29th and 30th.

The prevailing wind was south.

JULY.

The mean temperature was 73°, which is the station average for July. The highest temperature, 95°, occurred on the 24th; the lowest, 47°, on the 2d.

The mean relative humidity was 76 per cent. Fair weather prevailed. Rain fell on eight days. The total rainfall for the month was 3.13 inches, which is 0.23 inch above the station average for July. The greatest rainfall in 24 hours, 1.22 inch, occurred on the 3d.

An aurora occurred on the 16th.

The prevailing wind was southwest.

AUGUST.

The mean temperature was 71°, 1° above the station average for August. The highest temperature, 90°, occurred on the 8th and 9th; the lowest, 40°, on the 31st.

The mean relative humidity was 79 per cent. Fair weather prevailed. Rain fell on nine days. The total rainfall for the month was 6.15 inches, which is 3.00 inches above the station average for August. The greatest rainfall in 24 hours, 2.05 inches, occurred on the 11th.

The prevailing wind was north.

SEPTEMBER.

The mean temperature was 63°, 1° below the station average for September. The highest temperature, 86°, occurred on the 10th; the lowest, 34°, on the 27th.

The mean relative humidity was 80 per cent. Clear weather prevailed. Rain fell on five days. The total rainfall for the month was 1.27 inch, which is 1.92 inch below the Station average for september. The greatest rainfall in 24 hours, 0.77 inch, occurred on the 13th.

A heavy frost occurred on the 27th.

A thunder storm occurred on the 25th.

The prevailing wind was southwest.

OCTOBER.

The mean temperature was 52°, 2° above the station average for October. The highest temperature, 83°, occurred on the 1st, 3d and 8th; the lowest, 22°, on the 30th.

The mean relative humidity was 74 per cent. Clear weather prevailed. Rain fell on three days. The total rainfall for the month was 0.67 inch, which is 1.69 inch below the station average for October. The greatest rainfall in 24 hours, 0.33 inch, occurred on the 19th.

Light frosts occurred on the 11th and 13th.

Heavy frosts occurred on the 12th, 20th, 24th, 28th, 30th and 31st.

The prevailing wind was northwest.

NOVEMBER.

The mean temperature was 37°, which is 3° below the station average for November. The highest temperature, 69°, occurred on the 17th; the lowest, 8°, on the 20th.

The mean relative humidity was 82 per cent. Fair weather prevailed. Rain and snow fell on twelve days. The total snowfall for the month was 6.80 inches; the total rain and melted snow, 2.62 inches, 0.49 inch below the station average for November. The greatest rainfall in 24 hours, 0.57 inch, on the 14th. Snow fell on the 8th.

The prevailing wind was northwest.

DECEMBER.

The mean temperature was 29°, which is 3° below the station average for December. The highest temperature, 64°, occurred on the 7th; the lowest, 0°, on the 26th.

The mean relative humidity was 83 per cent. Fair weather prevailed. The total snowfall for the month was 5.0 inches; the total rainfall and melted snow, 1.85 inches, which is 0.70 inch below the station average for December. The greatest rainfall in 24 hours, 0.60 inch, occurred on the 6th.

The prevailing wind was west.

F. J. FALKENBACH, *Meteorologist.*

ERRATA.

Page 21, omit decimal point in third column of table III.

Page 122, for *Dissosteia*, read *Dissosteira*,

Page 126, for *Agrostis*, read *Agrotis*.

Page 127, for *Aphodius sewal*, read *A. serval;* for *Lacnosterna*, read *Lachnosterna*.

Page 128, for *Luperus thoracious*, read L. *thoracicus;* for *Rhyncophora*, read *Rhynchophora*.

Page 134, for *Uromyces polygonia*, *Pers.*, read *U. Polygoni* (Pers.) Fckl.; for *U. trifolii* Alb. and Schw., read *U. trifolii* (Hedw, f.) Lev.

Page 135, for *Puccinia Marie-Wilsonii* (?), read *P. Mariæ Wilsoni* (Clinton) (?); for *P. Maydis*, Carradori, read *P. Maydis*, Berenger.

Page 137, for *Phragmidium fragariæ* (DC) Rosm., read, P. *fragariæ* (DC) Wint.; for *Melampspora populina*, Wint., read *M. populina* (Jaq.) Lev.

Page 138, for *Æcidium grossulariæ*, Schum., read *Æ. grossulariæ*. D C.; for *Æ. geranii, read Æ. geranii*, DC.

Page 139, for *Æ œnotheræ*, read *Æ. œnotheræ*, Pk.; for *P. hastata*, read *P. hastata* Cke.; for *P. solida*, read *P. solida*, S.

Page 159 line nine from top, for LEPEDOPTERA, read LEPIDOPTERA

Page 140, for *P. saniculæ, read saniculæ*, Grev,; *for Coleosporium compositarum*, read *C. compositarum*, Lev.;for *Aster punicens*, read A. *puniceus;* for *Uredo filicum*, read *U. filicum*, Chev.; for *Æcidium compositarum*, read *Æ. compositarum*, Mart.; for *Æ. compositarum*, var. *eupatoriæ*, read *Æ. compositarum*, Mart. var. *enpatoriæ* (S) B.; *for Æ. cimicifugatum*, read *Æ. cimicifugatum*, S.

Page 153, line six from top, for say, read Say.

Page 161, line seven from top, for Obeira, read Oberea.

Page 166, line fifteen from bottom, for LEPIDOBTERA read LEPIDOPTERA.

Page 173, line nineteen from top, for *xylineformis*, read *xyliniformis*.

Page 178, line fifteen from top, for *glancaria*, read *glaucaria;* line one from bottom. for *glancaria*, read *glaucaria*.

Page 188, line seventeen from bottom, for *nemnralis*, read *nemoralis*.

Page 208, line five from top, for sufficinetly, read sufficiently.

Page 211, line seventeen from bottom, for FLEE, read FLEA; line twenty from bottom, for fiy, read fly, and for Tabinus, read Tabanus.

Page 234, line thirteen from top, for *and*, read and.

INDEX.

(ARTICLES MARKED * ARE ILLUSTRATED.)

Abutilon avicennæ XXXII
Acknowledgments XXVII
Æcidia, lists of 138, 140
Agriculturist, report of XXXI
Alfalfa VI, XXXII
Blackberries, insects affecting XXVI, 151
" summary of tests of 1892 XXXIII
Board of control, report of VII
Bordeaux mixture, dilute, formula for XXXIV
Botanist, report of XXX
Buildings, new XVII
Bulletins, summary of XXI
Cæoma nitens 137
Celastrus scandens 123
Chemist, report of XL
Coleosporia, lists of 137, 140
Copper-arsenic solution, formula for XXXIV
Corn, experiments of 1892 XXXI
" fertilizers on, *see Fertilizers.*
Dairy experiments of 1892 XXXII
Dairy tests, state XX
Director, report of XVI
Entomologist, announcement of 84
" annual report of XXXVI
Farmers' institutes XX
Fertilizers, coöperative test in Columbiana county 40
" " Licking county 42
" " Huron county 43
" " Butler county 45
" " Washington county 47
" summary of 16 tests on corn 48
" Station tests on corn 35
" " oats 52
" " crops in rotation 55
" " greenhouse crops 100
" summary of bulletin XXII
Financial statement XII
Fungicides, summary of experiments with XXXIV

Fusisporium culmorum ... 147
  “ *hordei* ... 149
  “ *lolii* ... 149
  “ *solani* ... 148
Garden vegetables, summary of work in 189 ... XXXIV
Gooseberries, notes on ... XXXIV
Greenhouses, plans of ... *XVIII
Greenhouses and greenhouse work ... 99, XXIV
  “ calendar of operations in ... 105
  “ crops suitable for forcing in ... XXV, 103
  “ fertilizers in ... XXIV, 100
  “ lettuce in ... XXV, 108
  “ sub-irrigation in ... XXIV, 101
  “ tomatoes in ... XXV, 106
  “ water bench in ... XXIV, 102
Gymnosporangium macropus ... 137
Horticulturist, report of ... XXXIII
Implements, seeds and plants received ... XXIX
Improvements begun ... IX
Indian mallow ... XXXII
Insectary, plan of ... *XX
Insecticides, summary of experiments with ... XXXIV
Insects affecting the blackberry and raspberry ... XXVI, *151
  “ destroying wheat under ground ... XXVI, *222
  “ found in stomach of robin, table ... 126
  “ which burrow in the stem of wheat ... XXIII, *59
Insects :—*Acronycta brumosa* ... 173
    “ *oblinita* ... 173
    “ *spinigera* ... 173
    “ *xyliniformis* ... 173
  Agrilus ruficollis ... *191
  Agriotes mancus ... 222
  Agonoderus pallipes ... 120
  American frit fly ... 81, *82
    “ raspberry beetle ... 189
  Anisota senatoria ... 172
  Anomala binotata ... 197
  Anthomyia (?) ... 189
  Anthonomus signatus ... *205
  Apatelodes torrefacta ... 187
  Aphelinus mali ... XXXVII
  Aphidius phorodontis ... XXXVI
  Aphis brassicaæ ... XXXVII
    “ *rubicola* ... 209
    “ *rumicis* ... XXXVI
  Aplodes rubivora ... 178
  Aphrophora quadrangulatus ... 210
  Attacus cecropia ... *170
  Bassareus mammifer ... 201
  Bembecia marginata ... *159
  Bibio albipennis ... 118, 123
  Black army worm ... 175
  Blackberry crown borer ... *159
    “ flea louse ... 209

Insects:—Blackberry leaf miner ... 152, 186
" midge ... 188
Blennocampa pauperca ... 152
Brachytarsus variegatus ... 67
Bud moth, the ... 182
Byturus unicolor ... 189
Cabbage aphis ... XXXVII
Cacœcia rosana ... 180
California tent caterpillar ... 173
Carpophilus brachypterus ... 191
Case-bearing blackberry leaf miner ... 186
Caterva catenaria ... *179
Cecidomyia (?) ... 187
Cecropia emperor caterpillar ... *170
Cephus pygmæus ... 69, *70
Ceratina dupla ... 158
Chain-dotted geometer ... *179
Chelymorpha argus ... 204
Cherry aphis ... XXXVII
Chionaspis furfurus ... *208
Chlamys plicata ... *200
Cicada septendecim ... 210
Clisiocampa catifornica ... 173
Clover leaf weevil ... XXXVIII
Cœtinius meromyzæ ... 76, 79
Comma butterfly ... 158
Companion wheat fly ... 79, 82
Corimelæna puticaria ... 211
Corn root worm ... XXXVIII
Corn sphenophorus ... 72
Cosmopepla carnifex ... 212
Cotatpa lanigera ... *197
Crane flies ... XXVI, *238
" as food of robin ... 131
Cryptocephatus binomis ... 201
" *quadruplex* ... 201
" *venustus* ... 201
Cynipid leaf gall ... 157
Daggar-moth caterpillars ... 173
Datana vngusii ... 121, 124
Diabrotica tongicornis ... XXXVIII
" *12-punctata* ... *202, *238
Diaspis rosæ ... 208
Diastrophus cuscutæormis ... 156
" *nebulosus* ... 157
Diptosis tritici ... XXXVII
Dissosteira carolina ... 122
Dog-wood saw fly ... 153
Dolerus arvensis ... XXXVII
Dryocampa senatoria ... 118
Empretia stimulea ... *166
Empusa aphidis ... XXXVI
Encyrtus flavus ... XXXVI
Eudemis botrana ... *180

Insects:—*Eupelmus allynii* 68
Eurytoma fulvipes 61
" *hordei* 60
" *secalis* 61
" *tritici* 60
Euschistus variolarius 212
Exartema permudana 181
Fall web worm 162
Fenusa rubi 152
Fifteen-spotted lady beetle 189
Flea-like negro bug *211
Giant root borer *198
Goldsmith beetle, the *197
Gortyna nitela *73
Grain sphenophorus 72, 82
Grape berry moth *180
Grapta comma 158
Green fly, the 109
Harpiphorus varianus 153
Heart worm, the 176
Hedgehog caterpillar 162
Heteropus ventricosus 68, 79
Hydrœcia nitela 176
Hyphantria cunea 162
Isosoma allynii 64
" *elymi* 64
" *grande* *65, *66
" *hordei* .... 59, 61, 64, XXXVII
" *tritici* *63, *65
Iulus impressus *215
Joint worm, the .... 59, *62, 82, XXXVII
Lachnosterna fusca *230
Lagoa crispata 166
Lasioptera farinosa 188
Leaf roller 185
Leather jackets *238
Lecanium hesperidum XXXVI
Limonius auripilis 191
Leptotrachelus dorsalis 68
Limax campestris XXXVI
Loxotænia musculana 187
Lygus pratensis *213
Macrodactylus subspinosus *193
Macrosiphum rubicola 209
Meadow katy-did *205
Melanoplus femur-rubrum 122, 123
" *spretus* *205
Melanotus communis .... XXXVII, *229
Meromyza americana *74
Mysia 15-punctata 189
Myzus cerasi XXXVII
Myzus mahaleb XXXVI
Nepticula rubifoliella 186
" *villosella* 186

Insects:—*Noctua fennica* ... 175
Oberea bimaculata ... 199
Œcanthus niveus ... 206
Œdemasia concinna ... 167
Ophion macrurum ... *172
Orange-striped oak worm ... 172
Orchelimum glaberimum ... *205
Oscinis (?) ... 79
" *coxendix* ... XXXVII
" *umbrosa* ... XXXVII
" *variabilis* ... XXXVII, *81
Oxyptilus tenuidactylus ... *180
Pachybrachys carbonarius ... 202
Pachyrrhina (?) ... *243
Paragus tibialis ... XXXVI
Paria 4-notata ... 202
Phemphigus rubi ... 209
Phoxopteris (?) ... 185
Phytonomus punctatus ... XXXVIII
Prionus laticollis ... *198
Prodeina lineatella ... 187
Psylla tripunctata ... 209
Pyramidal grapevine caterpillar ... 177
Pyrophila pyramidoides ... 177
Pyrrharctia isabella ... 122, 162
Raspberry and blackerry cane borer ... *199
" cane maggots ... 189
" geometer ... 178
" gouty-galls beetle ... *191
" leaf-roller ... 181
" plume moth ... 180
" root borer ... *159
" root gall ... 156
" saw fly ... 154
Red-humped apple tree caterpillar ... *167
Rhodites radicum ... 156
Rhynchites bicolor ... 204
Rocky mountain locust ... 205
Rose chafer ... *193
" scale ... 208
Saddleback caterpillar ... *166
Schizura ipomeæ ... 168
" *unicornis* ... 168
Scopelosoma sedus ... 177
Scurfy bark louse ... *208
Seed-like blackberry gall ... 156
Selandria rubi ... 154
Sepha rubifolii ... 209
Sericaria mori ... 187
Sesia hemizonæ ... 187
Seventeen-year cicada, the ... 210
Siphonophora avenæ ... XXXVI
" *cucurbitæ* ... XXXVII
" *rubi* ... 209

Insects:—*Sirex pygmæus* ... 70
- Snowy tree cricket ... 206
- *Solenopsis fugax* ... 157
- Southern corn root worm ... 202, *238
- *Sphenophorus parvulus* ... 72
- “ *sculptilis* ... *72
- Square spittle bug ... 210
- Stalk borer, the ... 63, 82, 176
- Stem gall midge of the blackberry ... 187
- *Stictonotus issosomatis* ... 68
- Strawberry weevil, the ... *205
- *Synchlora glaucaria* ... 178
- *Tabanus abdominalis* ... XXXVIII
- Tarnished plant bug ... *213
- Thick-nosed crane fly ... *243
- *Thrips tritici* ... 207
- *Thyatira scripta* ... 187
- *Tipula hebes* ... *238
  - “ *bicornis* ... 239, *247
  - “ *costalis* ... 245
- *Tmetocera ocellana* ... 182
- *Tymnes tricolor* ... 202
- Underground insect destroyers of wheat ... 221
- Unicorn prominent ... 168
- Upholster bee ... 158
- Waved lagoa ... 166
- Wheat midge ... XXXVII
  - “ thrips ... 207
- Wheat-steam saw-fly ... 69, *70, 82
  - “ maggot ... *74, *78, 82
- Wheat-straw worm ... *63, 82
- Wheat wire worm ... *222
- White grubs ... XXVI. *230
- Wire worms ... XXVI, *221

Japan clover ... XXXII

Lactuca scariola ... *141
- “ “ fungus parasite on ... XXXIX, *145

Lettuce as a greenhouse crop ... 108
- “ varieties of ... 111
- “ wild ... *141

Litigation affecting the Station ... VII

Location of the Station ... VIII

Mangolds and sugar beets, comparison of varieties ... 17
- “ “ “ continuous culture of ... *29
- “ “ “ cost of production ... 24
- “ “ “ disposal of leaves ... 30
- “ “ “ dry matter in ... 22
- “ “ “ experiments of 1892 ... XXXII
- “ “ “ planting close ... 23
- “ “ “ manuring ... 29
- “ “ “ transplanting ... *25

Melampsora populina ... 137

Melilotus Alba as a soil renovator ... 85

Meteorological summary for 1892 ... 249

Oats, comparison of varieties 3, 6. 12
" distribution of seed 14
" experiments of 1892 XXXI
" fertilizers on 52
" methods of planting 16
" sale of seed 20
treatment for smut 17
Personnel of Station, changes in X
Phragmidium fragaria 137
" *mucronatum* 137
Potato blight and scab, prevention of XXXV
Prickly lettuce *143
Publications of Station, summary of XXI
Publications received XXVII
Puccineæ, lists of 134, 139
Rainfall for 1892 250
" for 10 years 252
Raspberries, summary of tests of 1892 XXXIII
Removal of the Station ..... VII, XVI
Robin, food of the ..... XXV, 115
Rœstelia pyrata 137
Rusts of Ohio, preliminary list of 133
Scab in wheat 93, *147
Septoria consimilis ..... XXXIX *145
Smut in oats, treatment of seed for 17
" " loss resulting from 19
" wheat 93
Spraying orchards, summary of work 1892 XXXV
Strawberries, summary of tests of 1892 XXXIII
Sub-irrigation in the greenhouse 101
Sub-stations X
Sugar beets, *see mangolds and sugar beets.*
" " determination of sugar in XLI
Temperature for 1892 251
" " 10 years 252
Tomatoes as a greenhouse crop 106
Treasurer, report of XII
Uromyces, lists of 133, 139
Water bench, the 102
Weather, notes on for 1892 258
Wheat, after melilotus 85
" comparison of varieties 89
" degeneration of varieties 87
" field experiments with ..... XXIII, 83
" insects which burrow in the stem of ..... XXIII, 59
" methods of seeding 83
" scab in 93, *147
" smut in 93
" shrinkage in the granary 86
" yields for 8 years 97
Wild lettuce *141

BULLETIN

OF THE

Ohio Agricultural Experiment Station.

TECHNICAL SERIES.—VOLUME 1, NUMBER 3.
APRIL, 1893.

ENTOMOLOGICAL

AND

BOTANICAL PAPERS.

The Bulletin of this Station is sent free to all residents of the state who request it. Persons who receive duplicate copies of the Bulletin, or who do not care to receive any, are requested to notify the Station, as the edition is not sufficient to supply the urgent demand for it. All correspondence should be addressed to EXPERIMENT STATION, *Wooster, Ohio.*

NORWALK, OHIO.
THE LANING PTG. CO., STATE PRINTERS
1893.

. . . ORGANIZATION OF THE . . .

OHIO AGRICULTURAL EXPERIMENT STATION.

BOARD OF CONTROL.

Seth H. Ellis,	Springboro.
Hon. Joseph H. Brigham,	Delta.
R. H. Warder,	North Bend.
The Governor of the State, The Director of the Station,	*Ex-Officio.*

OFFICERS OF THE BOARD.

Seth H. Ellis,	President.
R. H. Warder,	Secretary.
Bertha E. Wildman,	Treasurer.

STATION STAFF.

Charles E. Thorne,	Director.
William J. Green,	Horticulturist and Vice-Director.
J. Fremont Hickman, M. A. S.,	Agriculturist.
Francis M. Webster,	Entomologist.
Bertha E. Wildman,	Bursar.
Edwin C. Green,	Assistant Horticulturist.
F. J. Falkenbach,	Chemist.

BULLETIN
OF THE
OHIO AGRICULTURAL EXPERIMENT STATION.

VOL. 1, NO. 3. TECHNICAL SERIES. APRIL, 1893.

TABLE OF CONTENTS.

Page.
Preface .... 150.
Article VII.— Methods of oviposition in the Tipulidæ. (Illustrated.) .... *F. M. Webster.* 151.
Article VIII.— A Dipterous Gall-maker and its Associates. (Illustrated.) .... *F. M. Webster.* 154.
Article IX.— Description of a new species of Gall-making Diptera. (Illustrated.) .... *John Marten.* 155.
Article X.—Description of a species of Chlorops reared from galls on Muhlenbergia mexicana .... *S. W. Williston.* 156.
Article XI.— Notes of some species of Ohio Hymenoptera and Diptero heretofore undescribed. (Illustrated.) .... *F. M. Webster.* 157.
Article XII.— Descriptions of new Parasitic Hymenoptera bred by F. M. Webster. (Illustrated.) .... *Wm. H. Ashmead.* 159.
Article XIII.— A Tachinid reared from cells of a mud-dauber wasp. .... *C. H. Tyler Townsend.* 165.
Explanation of plates .... 167.
Article XIV.— Additions to the Preliminary List of the Uredineæ of Ohio .... *Freda Detmers.* 171.
Article XV.— Bibliography of Ohio Botany .... *W. A. Kellerman.* 180.
Article XVI.— Experiments in the germination of treated seed. .... *W. A. Kellerman.* 201,
Article XVII.— Analytical Synopsis of the groups of Fungi. .... *W. A. Kellerman* and *Aug. D. Selby.* 206.
Article XVIII.— The Ohio Erysipheæ. (Illustrated.) .... *Aug. D. Selby.* 313.
Article XIX.—Corrections and additions to Moses Craig's catalogue of the uncultivated flowering plants growing on the grounds of the Ohio State University .... *W. A. Kellerman* and *Wm. C. Werner.* 224.
Article XX.— Distribution of and Stations for a few rare and interesting Ohio plants .... *Wm. C. Werner.* 232.
Article XXI.— New Plants for the Flora of Ohio .... *Wm. C. Werner.* 235.
Article XXII.— Notes on Rare Ohio plants .... *Aug. D. Selby.* 241.
Article XXIII.—New or Rare Plants of Ohio .... *W. A. Kellerman.* 241.

PREFACE.

The present number is a continuation of the series which was established in order to include the more technical work of the Station, not of especial interest to the ordinary farmer, but essential to Station workers. All of the botanical papers and the entomological papers by Mr. Webster form a part of the Proceedings of the Ohio Academy of Science. The former are included here, as they are directly in line with the work of the Station, and this series of our Bulletin has been selected as one of the official organs of the Ohio Academy of Science. They are not, however, to be taken as a portion of the work of the Station. The papers by Mr. Webster represent Station investigations, and the descriptive papers by Professors Williston, Townsend, Ashmead and Marten were prepared at our request and relate directly to the entomological papers, the descriptions of new species being published here for the first time.

ARTICLE VII.—METHODS OF OVIPOSITION IN THE TIPULIDÆ.

By F. M. Webster.

Tipula bicornis Loew.

Authorities differ as to the mode of oviposition among the Tipulidæ; and it is not improbable that there may be a difference of method in different species. Curtis opined that the British species oviposited while on the wing, and Miss Ormerod says that *Tipula oleracea* Linn., oviposits in or on the surface of the ground, while Dr. Riley states that he has witnessed the oviposition of an American species, *Tipula trivittata* Say, and the eggs are forced into the ground by means of a double pair of valves, something as in the case of our common locusts.

In the species under consideration, the terminal abdominal segment of the female, Plate I, Fig. 4 *A*, is much more obtuse than in some other of the American species, ending in a pair of broad, concave valves or plates, Plate II, Fig. 1 *Aa*, whose office appears to consist in holding the eggs in place and assist in directing them to within the reach of a second pair of organs. With the female standing on a horizontal surface, in a natural position, the egg, Plate I, Fig. 7 *Ad*, which is concave on one side and convex on the other, appears to pass down the oviduct with the concave surface downward, but on nearing the terminus of the oviduct the posterior end of the egg is thrown under and backward, or toward head of the insect thereby bringing the concave side upward, and lying, seemingly, directly under a small liguliform plate, Plate I, Figs. 5, 6, *Ab*, which is attached only at its base. The apical portion of this triangular plate appears to fit the concave side of the egg, which is prevented from going too far backward by the anal valves previously mentioned. It is here that the second pair of plates or valves, Plate I, Fig. 6, *Ae*, apparently the most important appendage, is called into play. This is situated just beneath or a little back of the triangular plate, their bases having very nearly a common origin, and is composed of two movable valves, or claspers (whose base is broadened into a thin flap, which, coming upward at the sides, forms a receptacle for the egg) which, when closed together, form a hemispherical cup having almost the exact form of one-half of the epicarp of the hickory nut; and each of the two parts, when opened, as faithfully represent one of the valves of the epicarp. When the egg is in position on the triangular plate these valves are pressed against and about it, inclosing it on all sides, leaving only a portion visible along the apex; and dropping downwards slightly, but gently, the egg is projected forth with a slight snapping sound, seemingly propelled in much the same manner as one would eject the pit from a ripe cherry by pressing it between the thumb and forefinger. Whether the liguliform plate follows the valves in this downward movement, or not, I could not determine, but think such is the case, as the egg is not projected directly backward, but deflects considerably downward. The movements of oviposition are made so quickly that it is exceedingly difficult to observe the exact action of the parts, and therefore I give them as they appeared to me. Further observation may require a slight revision.

I have an idea that the two elevations at the base of the liguliform plate, which is drawn as seen from beneath, may serve to keep the egg from slipping backward and may also assist in pushing it forward. At the base of plate, Plate II, *Aa*, Fig. 2, on the under side at x, are two loose appendages fixed at base and middle, forming, as it were, a sort of basal pocket for each of the claspers. The exact use of these I can not understand, but suspect they assist in some manner in holding, or, possibly, propelling the egg, as, in Pachyrrhina, they are reduced to what appears to me to be a mere cushion.

I wish it distinctly understood that I did not witness oviposition, except under artificial environments, and therefore it would not be best to take too much for granted. But, in view of the mechanism of the organs of oviposition, and the manner in which they are called into play, together with the fact that in the breeding cages the eggs were scattered about, without the least indication of a desire to secrete them, it seems at least doubtful about this species ovipositing in the ground, though it must be confessed the organs of oviposition have a strange resemblance to those of female locusts. There is, also, another, seemingly quite significant fact connected with the habits of oviposition in this species. While great difficulty was experienced in getting females of species having the upper plates or valves prolonged to a sharp point, to oviposit in confinement, these did so very readily, not appearing to care where the eggs fell, and when placed on a table it was found that some of them were projected a distance of ten inches. It would seem at least likely that if the life of the young larvæ depended upon the eggs being placed in the ground, there would have been some aversion, such as seemed to have been shown in *Pachyrrhina*, *Tipula costalis* and *T. angustipennis*, exhibited against their sacrifice.

The egg.—The egg is 0.8^{mm} in length, and from 0.3 to 0.4^{mm} in breadth, elongateovoid, strongly concave on one side and convex on the other, of a jet black color and highly polished.

Pachyrrhina sp?

PLATE II, FIGS. 3, 4.

The organs of oviposition in this species are very different from those of the preceding, giving to the posterior segment of the females a very different appearance. Instead of the broad valves we have a pair of chitinous forceps, Plate II, Fig. 2, *Ba*, while the lower plates are produced with the prolongations vertically flattened, and the base forms an elongate receptacle, Plate III, Fig. 1, *Be*. The liguliform plate, Plate III, Fig. 2, *b*, is less robust and partakes more of a cartilaginous than a chitinous nature, its office evidently being in part sustained by the teeth with which the interior basal part of the second pair of plates is provided. The two pair of plates, when not in use, close up and form a slender prolongation of the last abdominal segment. The egg, Plate II, Fig. 5, *Bd*. differs from that of the preceding species by being smaller and having five distinct grooves, presumably allowing the teeth of the lower plates to gain a stronger hold on the egg itself, and thus reënforcing the liguliform plate, which, as in the preceding, seems to fit into the concavity of the egg. The manner of oviposition is as follows: The egg, leaving the oviduct, drops into the second or lower pair of claspers and under the small liguliform piece, the concave side upward. Here it seems to be held in place while the upper organ or plate is drawn backward, the lower being at the same time slightly advanced until the two flattened prolongations drop in between the two upper ones, when there is a sharp click and the egg is thrown forth at an angle of probably 40 degrees. As with the preceding species, the rapidity of the movement renders it difficult to observe accurately or to determine the exact source of propulsion. The females of this species utterly refuse to oviposit in confinement, and it is only by capturing them in the fields, after they have probably begun oviposition, that one is able to secure eggs. Even here, however, we have not been able to witness undisturbed oviposition, and therefore not able to observe whether or not they use the combined organs with which to place the eggs in the earth, as their general contour would indicate might be the case. More especially does this seem possible as the preceding species, whose organs of oviposition do not seem fitted for placing eggs, oviposit freely in the breeding cage. Besides being grooved, the eggs of these Pachyrrhinæ are smaller and less robust than those of *Tipula bicornis*. The number of eggs which the female produces is also uncertain, as I have not been able to secure accurate data on that point.

Except those of the *Pachyrrhina*, I have found no eggs with grooves, though all are concavo-convex. Whether this curious, boat-shaped form has been brought about by necessities growing out of changes of environment and of the organs of oviposition, or whether the eggs are thus formed to meet another and entirely different requirement, it is just now quite impossible to say. These insects are now almost semi-aquatic in the larval stage. In Illinois, Indiana and Ohio I always find the larvæ especially abundant in low, flat, wet lands. In Louisiana, I found larvæ in limited numbers in the running water of ditches, and Dr. Riley told me some years ago that he had in his collection a larva obtained some leagues at sea. Besides, the larvæ of *T. costalis* has lived for weeks in glass jars with clover roots, both being submerged in water, and the former often floated about in a vertical position after the manner of many other, aquatic, Dipterous larvæ. Whether these eggs were thrown by accident into a pool of water by the female of *T. bicornis* or whether washed out of the ground in which they had been deposited by other species, they would be to some extent protected by their peculiar form, and would, therefore, the more readily float to the edges of such pools which, being thoroughly saturated with water, would fulfill all of the requirements of the young larvæ.

Whoever undertakes a systematic study of this interesting group of insects will certainly find in the organs of oviposition in the females some excellent characters for defining species. The males I have not studied but infer that here, too, some excellent characters might be found.

ARTICLE VIII.—A DIPTEROUS GALL-MAKER AND ITS ASSOCIATES.

By F. M. Webster.

Under the caption of "Insects Reared from Galls on *Muhlenbergia Mexicana*," I presented a short note at the Rochester meeting of the Entomological Club of the American Association for the advancement of Science, in which was given a list of these insects, that, up to that time, had only been hastily determined as to genera. I wish now to present a more detailed and finished report on this matter, as it very forcibly illustrates the riches which awaits the careful investigation of the insect fauna of this State. There can be no doubt but that the author of this gall (Plate II, Fig. 6) is a species of Diptera belonging to the family *Cecidomyiæ*. It may henceforth be known as *Lasioptera muhlenbergiæ* Marten, and the original description follows on page 155. This was not, however, the first to appear, as my first rearing was a species of *Chlorops* which may now be known as *Chlorops ingrata* Williston, described on page 156. This was followed by a species of *Pteromalus*, a genus in which the species are in much confusion, and hence this one cannot now be clearly identified. My next prize secured was *Ericydnus maculipennis* Ashmead, n. sp., see page 162. This is clearly a parasite on the *Chlorops*, and, strangely enough, while I secured a large number of specimens, every one was a male. Next came the *Lasioptera* and these were closely followed by *Megorismus lasiopteræ* Ashmead, n. sp., see page 160 a parasite on the gall maker. This list is probably correct and is to be taken as a revision of that published in Canadian Entomologist, Vol. XXIV, p. 243, which was based on determinations made for me at the Department of Agriculture at Washington. The Oscinid, there mentioned, turns out to be a *Chlorops* and the Euratomid and Eupelmus are both *E. maculipennis* Ashmead. Among the bracts of the gall were many eggs of a species of Orthoptera, and in all probability those of one of the Katy-dids, the female having used this gall, as she does those on willow, for the purpose of secreting her eggs. Habitat, Ill., Ind., Ohio, Canada.

While preparing a description of this species I learned that Prof. Marten had also studied it in Illinois, and had included his description in a paper to be published in the Bulletin of the Illinois State Laboratory of Natural History. Through the courtesy of Prof. S. A. Forbes, Director of the Laboratory, this description was withdrawn and is published in the following pages.

Just as this Bulletin is ready for the press I have had the pleasure of examining another lot of galls, received from Prof. McFadden, March 27, 1893. These were, with one exception, what I had supposed to be aborted galls. On close examination, I found that the supposed perfect gall, only, contained larvæ of Lasioptera, while the supposed aborted galls, each near the crown of base, contained a single puparia in a vertical position. From these last I invarably rear the Chlorops, which tends to prove that these are two distinct species of galls formed by two species of Diptera, the one figured in Plate II, Fig. 6, being that of *L. muhlenbergiæ*, the other by *C. ingrata.*

In the stems of this last consignment of galls I find evidences of their having been inhabited by a larva, and it is possible that he who follows this interesting matter farther will be rewarded by rearing another inhabitant—a phytophagus species allied to *Isosoma.*

ARTICLE IX.—DESCRIPTION OF A NEW SPECIES OF GALL-MAKING DIPTERA.

By John Marten.

Lasioptera muhlenbergiæ, n. sp.

Female:—Length 3 to 3.5$^{\text{mm.}}$ General color pitchy black or brownish black. Antennæ 19 (17+2) jointed, black, fading to dusty towards the tips; joints short, sessile, clothed with short hairs; basal joints tinged with yellowish brown. Face tinged with yellowish brown, and having a silvery white reflection in certain lights; it also has a few scattered black hairs. Thoracic dorsum shining pitchy black with some reddish brown about the base of the wings and on the posterior angles of the mesothorax. Scutellum black with reddish brown margins, somewhat transparent in appearance. Metathorax and pleura reddish brown, the latter with a black spot commencing anterior to the base of the wing and reaching, with a slight interruption, to the middle coxa. Halters yellowish, with the head and outer part of the pedicel covered with pitchy black scales which give them a dense black appearance. Wings dusky; costa and the first and second longitudinal veins so densely covered with black scales and hairs as scarcely to be distinguished when the scales are intact; base of wing pale yellowish. Coxæ and femora yellowish; distal half of femora with black scales, becoming more dense towards the apex; tibiæ and tarsi completely covered with black scales. Abdomen reddish brown in ground color, densely covered with pitchy black scales; scales less dense on the venter; ovipositor reddish yellow, becoming pale yellow, almost white at the tip.

Male:—About the same length as the female, but more slender. Not nearly so black in general color as the female, but smoky or very brown black with a pitchy reflection. Antennæ 16 to 18 (14+2 or 16+2) jointed.

Described from numerous reared specimens that emerged from imbricated, leafy galls formed of aborted lateral branches on *Muhlenbergia Mexicana*, at Champaign, Ill. Specimens emerged from May 9 to June 10, 1892. By the abortion of the branch the leaves are brought close together, overlap each other and form a cone shaped gall, Plate II, Fig. 6. The larvæ lie singly or several together on the inner bases of the leaves forming the gall. They are of a peculiar pale yellowish color.

The pupa is reddish yellow, becoming darker reddish or even orange colored with age. When ready to pupate the old larval skin is pushed down to the tip of the abdomen where it remains adhering to the last segment. The pupa forms rapidly and without a puparium. The thin pupal skin is usually left attached to the old larval skin when the imago emerges.

There is but one generation in the year, the winter being passed in the larval stage.

ARTICLE X.—DESCRIPTION OF A SPECIES OF CHLOROPS REARED FROM GALLS ON MUHLENBERGIA MEXICANA, BY F. M. WEBSTER.

By S. W. Williston.

Chlorops ingrata n. sp.

Male, Female:—Yellow, but little shining; three dorsal stripes, a supra-alar vittula, the posterior margins of the abdominal segments, two occipital lines, and small spots on the pleuræ, black; frontal triangle very large, luteous. Length 3-3½$^{\text{mm.}}$

Verticle triangle very large, reaching acutely to the anterior margin of the front; in the male nearly contiguous above with the eyes; shining luteous, with a deep median groove. Face strongly receding, the margins of the facial ridges and of the cheeks, brown; cheeks very broad. Third joint of antennæ rounded, blackish on the upper margin. Thorax yellow, but little shining, clothed with short black hairs; the rather broad corsal stripes, a supra-alar vittula, a small humeral spot, three or four pleural spots, and the metanotum, black. Abdominal segments each with a broad posterior black band. Femora black or dark brown, the tips and the tibiæ yellow or yellowish; the middle portion of the hind tibiæ, and all the tarsi brown or brownish. Wings cinereous hyaline, the third and fourth veins divergent.

Two specimens, Ohio, Prof. F. M. Webster.

ARTICLE XI.—NOTES ON SOME SPECIES OF OHIO HYMENOPTERA AND DIPTERA HERETOFORE UNDESCRIBED.

BY F. M. WEBSTER.

The following new species of parasitic Hymenoptera and Diptera, though for the most part described in another part of this bulletin, and the host insects, or host plants, as the case may be, are usually given by the authors, yet in some cases additional notes may be added that may be of value to those who study them from a biological standpoint. In a very few cases I have included descriptions of species found outside of the State, but these will more than likely be found here sooner or later.

Heptameris oscinidis. This is given as a parasite on *Oscinis variabilis.* There is as yet some uncertainty about the validity of the species to which we are giving this latter name. There is no doubt about this being a host of *H. oscinidis*, but two other species of Oscinis occur in this locality in company with *variabilis*, and I have reared all of them from the same lot of young wheat. One of these is *O. umbrosa* Loew, described from Pennsylvania, and the other is as yet undetermined. All are abundant in wheat fields, and the puparia in spring are found in the same locality on the plants as are those of the Hessian fly.

Apanteles orgyiæ. This might almost be termed an egg parasite, as they were reared from the hibernating chrysalis of the female Orgyia, which is little more than a sack of eggs. An undetermined species of Pteromalus is likely to prove a secondary parasite.

Megorismus lasiopteræ. There is no doubt about the male of this being a parasite on Lasioptera.

Meraporus bruchivorus. This may prove to be exclusively a western species, though it is not unlikely to be parasitic on other species of the genus Bruchus.

Catolaccus tylodermæ. As the host, *Tyloderma foveolatum*, is everywhere abundant, in this State, breeding in the stems of the Evening Primrose, *Œnothera biennis*, it is sure to be found within the State in the near future.

Arthrolytus apatelæ. I found on September 10, a speciman of this species under the body host, which had in this case evidently been killed by *Rhogas intermedius* Cress. It does not appear to be abundant.

Ericydnus maculipennis. This must be parasitic on *Chlorops ingrata.* Though I reared over fifty examples not a single female was to be found among the number. Therefore the female is yet to be discovered.

Encyrtus clisiocampæ. This is, I believe, the first species of this genus to be reared from eggs of Clissiocampa. Though reared from eggs from Indiana it will doubtless be found in Ohio also.

Websterellus tritici. Plate II, Figs. 1 and 2. This will, I feel quite certain, prove to be a very useful parasite on *Isosoma hordei*, and is not itself phytopagus and the true gall maker. My reasons for this belief have from the beginning been, (1st.) That it emerges at the wrong season of the year to be a true wheat insect, there being no growing grain at the time in which the females could oviposit. (2d.) That I have observed them ovipositing in the galls from which they emerged. (3d.) That all of the other parasites reared from these galls, viz., *Semiotellus chalcidiphagus, Merizus isosomatis* and *Eupelmus allynii* are all of them parasitic on species of Isosoma. (4th.) That the general form of these galls, Plate III, Figs. 3 and 4, except in some minor features, agree with those of the normal form of *I. hordei* as given by Harris and Fitch. The species seems quite abundant in the vicinity of Wooster, Ohio.

Besides the foregoing, I have reared the following, descriptions of which have not yet appeared. The determinations are those given me by the Entomologists of the U. S. Department of Agriculture, and while a special agent of the Division of Entomology.

Elachistus websteri Ashmead, *M S.*

Hemiletes drassi Howard, from eggs of spiders.

Haltichella sp. from *Solenobia walshella.*

Aphelinus mali Hald. This species was described in 1851, from specimens of the female, but the male has heretofore been unknown. Both sexes were reared by myself from *Mysus mahaleb* infesting young turnip plants, in the insectary.

Chlorops ingrata, reared from independent galls on Muhlenbergia as has been already explained in another paper.

Sarcomacronychia trypoxylonis. This was reared at Columbus, Ohio, from mud cell collected by my assistant, Mr. J. S. Hine. On my removal to Wooster, the cells were left in the care of Mr. Hine, who reared from them two specimens of *Trypoxylon politum* Say.

ARTICLE XII.—DESCRIPTIONS OF NEW PARASITIC HYMENOPTERA BRED BY PROF. F. M. WEBSTER.

BY WM. H. ASHMEAD.

Family CYNIPIDÆ. Genus HEPTAMERIS FÖRSTER.

(1) *Heptameris oscinidis sp. n.* ♀ Length 1$^{mm.}$ Black, highly polished impunctate; legs and the six basal antennal joints reddish yellow wings hyaline, strongly fringed. The antennæ are as long as the body, 13-jointed, the seven terminal joints stouter than the preceding, about three times as long as thick, the last being slightly the longest, the four funiclar joints very slender, nearly of an equal length, the first being very slightly the longest. Thorax very slightly shorter than the abdomen, the mesonotum highly convex without furrows and a little longer than wide; scutellum foveated at base, the small oval cup on disk surrounded by striæ, the cup itself smooth and polished with a small fovea at apex. Marginal cell of anterior wing large; the first abscissa of the radius slightly curved and a little shorter than the second, the latter straight.

Described from 2 ♂ specimens reared by Prof. F. M. Webster, at Wooster, Ohio, from the larva of *Oscinis variabilis* living in the stems of wheat.

Family BRACONIDÆ. Genus APANTELES FÖRSTER.

(2) *A. orgyiæ sp. n.* ♀ Length 2.2$^{mm.}$ Black, shining, finely sparsely pubescent; mandibles, palpi and legs, except hind coxae, reddish-yellow, or yellowish; scape black; flagellum brown-black or dark brown; wings hyaline; tegulæ, costæ and stigma, pale brownish-yellow, the internal nervures pale or hyaline.

Head transverse much narrower than the thorax, a little more than twice as wide as long, the vertex convex, smooth, with occipital margin rounded and feebly, sparsely punctate; ocelli prominent, red; face below antennæ slightly prominent, with a median carina but not sharply defined, the surface shining but feebly rugulose or alutaceous; clypeus with a distinct, small, rounded fovea on each side at the basal lateral angles; cheeks rounded, feebly sparsely punctate, the punctures more distinct and confluent near the malar furrow. Antennæ as long as or a little longer than the whole insect, slender and very gradually acuminate toward tips; scape about 2½ times as long as thick, black, except at juncture with the head; annulus minute, yellowish; flagellum dark brown, covered with a short fine pubescence, the first three joints about equal in length, nearly four times as long as thick, the following joints very gradually subequal to the last, the last very slender, conic, and only a little longer than the preceding.

Thorax shining, punctate, the punctures confluent only anteriorly, sparser and feebly defined towards the scutellum; scutellum smooth, shining, impunctate with a crenulate furrow across its base; metepisterum triangular, punctate along the margins; mesopleura with a long deep femoral furrow, smooth and shining except anteriorly and beneath the tegulæ, the surface here being punctate; metathorax coarsely rugose, impressed on each side of the middle posteriorily and without a distinct median carina, although the pleural carinæ are more or less distinctly defined; metepisterna smooth, polished, the pleura being coarsely rugose and between these two sclerites there is a large deep fovea.

Legs, except the hind coxæ, uniformly reddish-yellow, rarely with a faint dot at tip of posterior femora above; tibial spurs scarcely half the length of first tarsal joint.

Abdomen not longer than the thorax, flat above, carinate and compressed towards apex beneath, the hypopygium being prominent and plow-share shaped, the ovipositor hidden or with only the tip exposed. The abdomen appears entirely black, but in the coxal furrow or the depression caused by the large hind coxæ, (being the sides of the first, second and third ventral segments) it is reddish piceous. Shield of first dorsal segment trapezoidal, as wide as the segment and as long as the second and third segments united, the latter sub-equal; the first and second segments are rugose, the following all smooth, polished.

Hab.—Ohio.

Approaches apparently nearest to *A. Koebelei* Riley, but differs in color of the legs, sculpture and in the structure of the dorsal abdominal segments, the second being without the oblique furrows.

Bred by Prof. F. M. Webster from the hibernating chrysalis of *Orgyia leucostigma.*

Family CHALCIDIDÆ. Subfamily PTEROMALINÆ. Genus MEGORISMUS Walker.

(3) *M. lasiopteræ sp. n.* ♂ Length 2.8$^{mm.}$. Golden green, closely punctate; sides of thorax, except the posterior part of the mesopleura, and the metathorax, bluish-green; scape, pedicel, mandibles, and legs, pale ferruginous.

The head is transverse wider than the thorax with a broad vertex, the lateral ocelli a little closer to the margin of the eye than to each other. Antennæ subfiliform, 13-jointed, the pedicel small, the first funiclar joint the longest and about twice as long as the pedicel, the following joints very gradually becoming shorter, the last being a little wider than long; club a little longer than the last two funiclar joints united. Pronotum transverse, quadrate, narrower than the mesothorax and anteriorly triangularly contracted at junction with the head; mesonotum with furrows entire but delicately indicated posteriorly; scutellum with no cross-furrow; metanotum long, rugose, and with 3 carinæ. Wings hyaline, the tegulæ and venation pale ferruginous, the marginal vein slightly shorter than the postmarginal, stigmal oblique, subclavate, and nearly as long as the marginal. Abdomen oblong-oval, bronzy-green, petiolated, the petiole stout, about twice as long as thick, rugose, with a delicate longitudinal carina above; first body segment the longest, almost as long as the following united, smooth, the following segments subequal and under a strong lens exhibiting a finely reticulate sculpture.

Hab.—Westerville, Ohio.

Described from a single male, bred from a Cecidomyiid larva, *Lasioptera muhlenbergiæ*.

Genus MERAPORUS Walker.

(4) *M. bruchivorus sp. n.* ♂ ♀. Length 2 to 2.5$^{mm.}$ Black, sometimes approaching blue-black, closely punctate or granulate and covered with sparse, short, white hairs, the head behind the ocelli with fine, transverse, grooved lines; knees, tips of tibiæ and the tarsi, except the terminal joint, white or light honey-yellow; abdomen æneous.

The head is transverse, a little wider than the thorax, with the cheeks and lower part of the face smooth. Antennæ, except extreme base of the scape, or at its origin, brown-black, subclavate, pubescent, the first funiclar joint small, shorter than pedicel or the following funiclar joints, the others very slightly longer than wide. Metathorax with a prominent neck. Wings hyaline, the venation yellowish, the marginal vein nearly twice as long as the stigmal, the postmarginal only one-third longer than the stigmal. Abdomen conic-ovate, about as long as the head and thorax united, or very slightly longer. The male has all the tibiæ, except sometimes the anterior pair, brownish; the marginal vein is only a little longer than the stigmal; the abdomen is oblong-oval; while the antennæ are covered with a denser pubescence.

Hab.—Manhattan, Kansas, Lafayette, Indiana, Spirit Lake, Iowa.

This species was first sent to me several years ago, by Mr. C. L. Marlatt, of Manhattan, Kansas, who reared it from a Bruchus, living in the seed pods of some plant in that state. Prof. F. M. Webster has recently reared it from *Bruchus exiguus*, living in the seeds of *Amorpha fruticosa* collected at Spirit Lake, Iowa, by Dr. J. C. Arthur.

Genus CATOLACCUS Thompson.

(5) *C. tylodermæ sp. n.* ♂ ♀. Length 3 to 3. 6$^{mm.}$ Dull brownish to bluish-black, closely punctate and covered with exceedingly short, sparse white hairs; abdomen, in ♀, conic-ovate, longer than the head and thorax united, metallic, at base above cupreous, towards apex and beneath bluish; scape and legs pale ferruginous or brownish-yellow, the coxæ and femora, except distal ends, brown-black or submetallic, the tibiæ at the middle more or less brownish or obfuscated; flagellum brown, subfiliform, the first funiclar joint the longest, about 2½ times as long as thick,

the following joints gradually subequal. Metathorax very short. Wings hyaline, the venation yellowish, the marginal vein long, about three times as long as the stigmal, or one-half longer than the postmarginal.

The male is the smaller and differs in having the tibiæ usually pale, or exhibiting only a dusky spot toward the base, the abdomen being long-oval, about two-thirds the length of the thorax, much depressed, bluish, but ferruginous or brownish above and beneath towards base.

Hab.—Indiana, and Ithaca, New York.

This species has been reared in Indiana by Prof. Webster, and at Ithaca, New York by Mr. F. H. Chittenden, from the larva of a Coleopteron, *Tyloderma foveolatum*.

Genus ARTHROLYTUS Thompson.

(6) *A. apatelæ sp. n.* ♀. Length 1.5$^{mm.}$ Black, shining, although exhibiting a fine scaly punctation; scape and legs, honey-yellow, or pale ferruginous; all femora, and the posterior tibiæ broadly at the middle, brown; flagellum subclavate, brown. The head is broad, much wider than the thorax, the vertex being broad and rounded. The antennæ are inserted a little below the middle of the face, the funiclar joints being short, not or scarcely longer than wide, the club somewhat large, fusiform. Thorax short, the mesonotum being about twice as wide as long, with the parapsides indicated only anteriorly; collar distinct but narrowed medially; scutellum convex; metathorax short. Wings hyaline, the marginal vein twice as long as the stigmal, the postmarginal not longer than the stigmal. Abdomen conic-ovate, a little longer than the head and thorax united.

Hab.—Wooster, Ohio.

Bred by Prof. Webster, from the larva of *Apatela populi* Riley.

Genus ERICYDNUS Walker.

(7) *Ericydnus maculipennis sp. n.* ♂.—Length 3 to 3.1$^{mm.}$ Brownish-yellow; eyes, scutellum and mesopleura posteriorly dark brown; metathorax and abdomen, except at base, blue-black; triangular piece before the tegulæ and the legs except sometimes the middle tibiæ outwardly and the hind femora and tibiæ, except the basal one-third, which are fuscous, honey-yellow; anterior wings with the apical two-thirds, except two triangular nearly confluent spots at the middle, fuscous, the basal one-third and the two triangular spots hyaline. The head is wider than the thorax, the surface microscopically shagreened with a few scattered punctures; ocell 3 in a triangle, all the same distance apart but the laterals almost touching the eye. Antennæ 11-jointed, subfiliform. Thorax convex, shining with a sparse microscopic pubescence, pronotum sub-triangular, the posterior margin triangularly emarginated; scutellum convex, twice as long as wide at base, the axillæ meeting at the base.

Middle legs the longest, the tibial spurs as long as the first tarsal joint. Abdomen oblong-ovate, as long as the thorax.

Described from several males reared by Prof. Webster from *Chlorops ingrata.*

Subfamily ENCYRTINÆ. Genus ENCYRTUS Dalman.

(8) *E. clisiocampæ sp. n.* ♀.—Length 0.8$^{\mathrm{mm.}}$ Æneous or dark bronzy-green; the mesopleura blue-black; tip of scutellum violaceous; antennæ, coxæ, femora, and tibiæ toward base outwardly, pale brown; rest of legs light honey-yellow. The whole surface is smooth, shining; the axillæ do not quite meet at the base of the scutellum; the eyes slightly converge toward the mouth; the vertex not especially widened; the lateral ocelli close to the eye, while the anterior ocellus is on the extreme margin of the facial impression. Antennæ 11-jointed, subclavate, the funiclar joints scarcely longer than thick, the first two united being only as long as the pedicel, while the club is fusiform not obliquely truncate. Wings hyaline, the margins not fringed, the marginal vein punctiform, the postmarginal scarcely longer, while the stigmal is subclavate about twice as long as the marginal. Abdomen sessile, short, subtriangular, not quite as long as the thorax, æneous, the membranous attachment to the metathorax, which is visible as a narrow fold, being whitish or carneous.

In the male the legs are pale, the femora and tibiæ being only slightly dusky, the abdomen being smaller and much depressed, while the antennæ are subfiliform, paler brown, with a long pubescence, the funiclar joints being from 1½ to 2 times as long as thick. Hab.—Franklin, Indiana.

Bred from the eggs of *Clisiocampa disstria* Hbn.

(9) *E. pleuralis sp. n.* ♀.—Length 1.5$^{\mathrm{mm.}}$ Æneous black or submetallic; tip of scutellum somewhat cupreous; head black; scape, mesopleura and legs, ferruginous, the posterior femora obfuscated; thorax smooth, impunctured. The head, on vertex, is distinctly punctate, the lateral ocelli almost touch the eye while the eyes are large, rounded, pubescent. Antennæ 11-jointed, clavate, the flagellum brown-black, with the funiclar joints wider than long. Wings hyaline, pubescent, and with a short cilia at margins, the marginal vein about 2½ times as long as thick, (or as long as the stigmal with its club), brown, post-marginal scarcely longer. Abdomen sessile, ovate, about as long as the thorax. Hab.—Wooster, Ohio.

Described from a single specimen, bred by Prof. F. M. Webster from a bracket-like fungus found on a stump, infested with the larvæ of Atomaria and other fungous beetles.

The funiclar joints in this species closely resemble those to be found in the genus Aphycus, but otherwise it resembles Encyrtus.

Family TORYMINÆ. WEBSTERELLUS gen. nov.

Stature and general appearance of *Monodontomerus* Westwood, with a similar venation and with the hind femora armed with a single tooth beneath toward apex; but the prothorax, although large, is more rounded anteriorly, the scutellum has no transverse furrow behind the middle, the metathorax with oval spiracles, the hind coxæ very long, while the abdomen is sessile, in female conically produced with a long ovipositor, in male oblong oval. In both sexes the first segment is the longest with the posterior margin incised at the middle.

The genera in the Toryminæ with the posterior femora toothed Plate I. Fig. 3, are: (1) *Monodontomerus* Westwood; (2) *Diamorus* Walker; (3) *Holcaspis* May; (4) *Oligosthenus* Förster; and (5) *Cryptopristus* Förster, all of which except the last are represented in my collection.

Websterellus is at once separated from the first two by the absence of a cross-furrow on the scutellum and by the incised first abdominal segment; from the third by a longer more oblique stigmal vein, shorter metathorax, longer posterior coxæ, the much longer conically produced abdomen and the incised first abdominal segment; and from the fourth and fifth by the shape of the abdomen, venation, and the incision of the first abdominal segment. In *Oligosthenus* the posterior margin of the first abdominal segment is straight in both sexes, while in *Cryptopristus* it is straight only in the male.

It has given me great pleasure to be able to dedicate this interesting new genus to my friend Prof. F. M. Webster, the discoverer, who is so well known for his valuable contributions to economic entomology.

(10) *Websterellus tritici sp. n.* (Plate II, Figs. 1, 2. Plate III. Figs. 3, 4). ♀.—Length 3 to 3.2$^{\mathrm{mm}}$ ovip. 1.8 to 2$^{\mathrm{mm}}$ Bluish green, confluently punctate, the upper part of head, the mesonotum and scutellum bronzed-green; the face, cheeks, sides of pronotum and abdomen, especially at sides, with a moderately dense white pubescence, the pubescence elsewhere sparse; all tibiæ and tarsi honey-yellow; wings hyaline, the female with a faint cloud beneath the stigmal vein; the venation brown, the marginal vein long, two-thirds the length of the submarginal, the post-marginal about two-thirds the length of the marginal, the stigmal a little shorter than the post-marginal at an oblique angle of about 20 degrees, and with a short vein at the tip which is directed towards the margin. Plate I. Fig. 1.

In the ♀ the antennæ are subclavate, 13-jointed, with the scape and club honey-yellow, while the abdomen is sessile, conically produced, nearly twice the length of the head and thorax united, the first segment being one-third its whole length, and the ovipositor is almost as long as the abdomen and thorax united,

The antennæ in the male are entirely black, with the flagellum filiform, stout, covered with a short dense pubescence, the pedicel being very small, while the abdomen is oblong-oval not quite as long as the thorax, the first segment only as long as the 2d., 3d, and 4th, segments united. Plate I, Fig. 2.

Described from several specimens reared by Prof. F. M. Webster, at Wooster, Ohio, from galls on the stems of wheat.

ARTICLE XIII—A TACHINID REARED FROM CELLS OF A MUD-DAUBER WASP.

By C. H. Tyler Townsend.

The fly described below was sent me by Professor F. M. Webster, with the note "reared from nest of some species of mud-dauber wasp." The mud-dauber wasps of the more northern portions of the United States belong largely to the genus Pelopæus. In Texas, and other parts of the south, a wasp of the genus Trypoxylon builds narrow mud cells, arranging them not only side by side but end to end, thus forming long tubes. The cocoon of the Trypoxylon is tough, thick, and of a dark brown; while that of Pelopæus is thin, yielding, and golden brown in color (See 2d Rep. U. S. Ent. Com., p. 266). These points will serve to identify the cells of the two genera.

In reply to an inquiry concerning the mud cells from which the tachinids were bred, Professor Webster sent me a number of the cells. These I recognize as those of Trypoxylon. They are long, and obliquely ribbed on the outside, the ribs from each side meeting on the median longitudinal line. The cocoon is stiff, hard in texture, dark brown in color, thin and brittle, except that the tail end has a thick lighter colored cap within. It is enveloped in a small amount of silk. Many of the tachinid puparia were found in the débris of the cells. In one case two puparia were glued together side to side, the heads pointing the same way.

Sarcomacronychia trypoxylonis n. sp. ♂. Eyes and frontal vitta dark brown; front and sides of face deep golden; front slightly narrowed anteriorly, about one-fourth width of head; strongest pair of ocellar bristles directed strongly forward; the two posterior pairs of frontal bristles strongest, directed backward; the other frontal bristles about same size, mostly directed forward, in two rows on each side of front as characteristic of this genus; face and cheeks silvery, occiput cinereous; antennæ and arista black, third antennal joint about one and one-half times as long as second (or slightly shorter); proboscis brownish, base and tip lighter; palpi blackish, rufous in middle, cylindrical in shape. Thorax and scutellum silvery cinereous, with three heavy black vittæ continued on scutellum, clothed with bristly hairs and a few macrochaetæ; pteuræ silvery, with a black vitta from humerus to base of wings scutellum with an apical decussate pair of maçrochaetæ, two lateral pairs, and some weaker bristles. Abdomen rather elongate oval, clothed with bristly hairs, blackish, anal segment rufous; segments one to three silvery on sides and beneath, and each on dorsum with a median pair of silvery pollinose spots or patches, leaving a more or less distinctly defined median dark vitta which is faintly continued on anal segment; anal segment more or less silvery pollinose, sometimes blackish on base (or greater portion in some badly preserved specimens); hypopygium blackish; segments one and two each with a median marginal and a lateral marginal pair of macrochaetæ, third segment with about ten marginal, and anal segment with a marginal row. Legs entirely blackish, femora slightly silvery, claws and pulvilli elongate. Wings grayish hyaline, venation typical; tegulæ whitish, with a pale straw-color tinge; halteres pale rufous, stalk darker.

♀. Differs in the short claws, the front less than one-fifth width of head anteriorly, and the general smaller size.

Length of body, 6–7½ mm.; of wing, 4⅓–6 mm.

Described from twelve specimens, reared from cells of a mud-dauber wasp, *Trypoxylon politum* Say, at Columbus, Ohio, by Professor Webster. Issued June 6, 1892. This species differs from *S. unica* Twns. by its pronouncedgolden front and sidesof face; from *S. floridensis* Twns. by the same character and by its larger size; from *S. sarcophagoides* Twns. by the golden front and sides of face, smaller size, and less marmorate marking of the abdomen; and from *S. aurifrons* Twns. by its rufous anus. The front of the ♂ in this genus is wider than that of the ♀.

EXPLANATION OF PLATES.

PLATE I.

Fig. 1. *Websterellus tritici* ♀.
Fig. 2. " " ♂.
Fig. 3. Posterier leg showing femoral tooth.
Fig. 4. Organs of oviposition of *Tipula bicornis.*
Fig. 5. Liguliform plate greatly magnified.
Fig. 6. Lower valves showing position of liguliform plate.
Fig. 7. Egg of *Tipula bicornis*, greatly enlarged.
Figs. 1, 2, 3, 4, drawn by Miss Detmers. Figs. 5, 6, 7, by Mr. John S. Wright.

PLATE II.

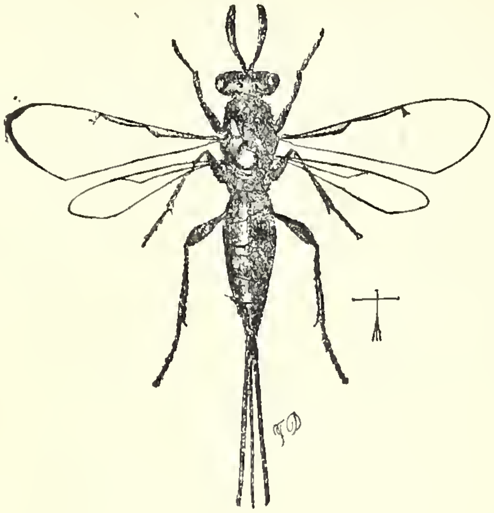
Fig. 1. Upper valves, organs of oviposition in *Tipula bicornis.*
Fig. 2. " " " " " *Pachyrrhina* sp.
Fig. 3. *Pachyrrhina* sp? slightly reduced.
Fig. 4. " " body about natural size.
Fig. 5. " " eggs, greatly enlarged, showing opposite sides.
Fig. 6. Gall formed by *Lasioptera muhlenbergiæ.*
Fig. 1, drawn by Mr. Wright; the others by Miss Detmers.

PLATE III.

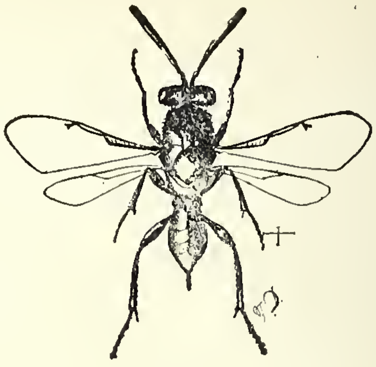
Fig. 1. Organs of aviposition of *Pachyrrhina* sp.
Fig. 2. Lower valves and liguliform plate.
Figs. 3–4. Deformities in straws caused by the larvæ of *Isosoma hordei.*
Fig. 5. *Uncinula Columbiana* sp. nov.:

a, Perithecium with appendages, top view X 75; *b*, same, side view, from hanging drop X 75; *c*, tips of appendages, strongly magnified; *d*, an ascus with spores X 360; *e*, leaf showing distribution of the perithecia, natural size.

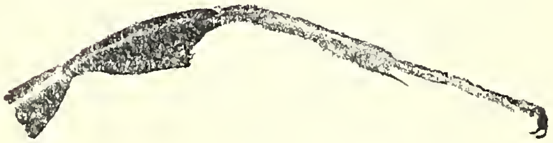
Fig. 1, 2, drawn by Mr. Wright; 3, 4, by Miss Vinnie Cunningham; 5, by L. G. Selby *ad noteram.*



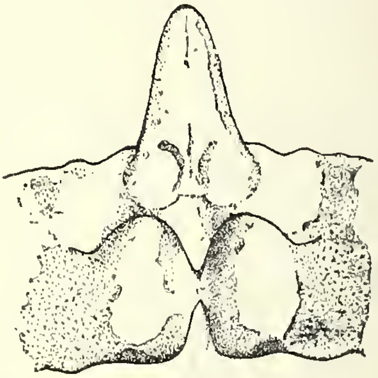
1



2

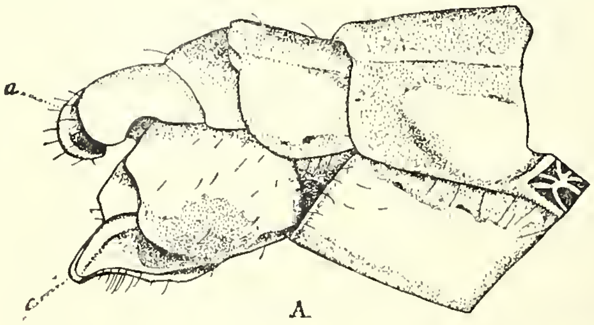


3



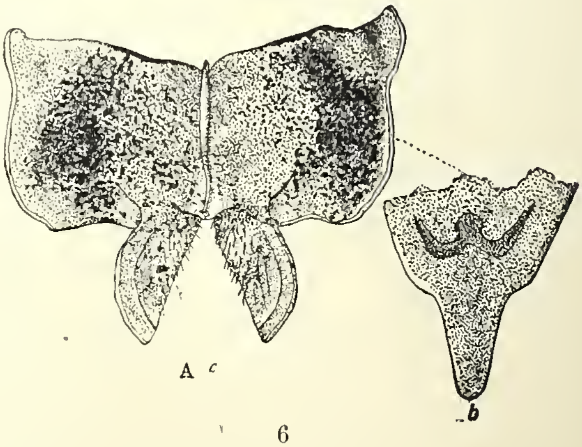
A *b.*

5



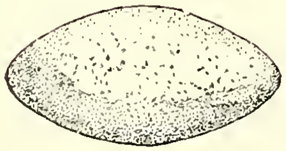
A.

4



A *c*

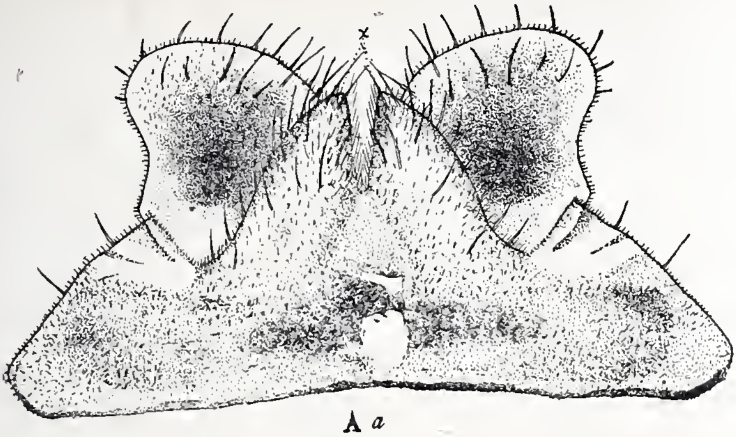
6



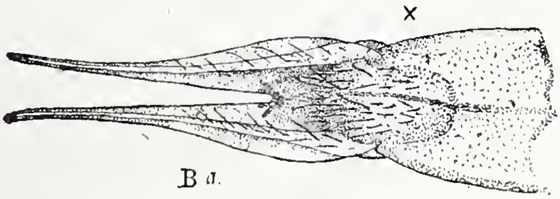
A *d*

7

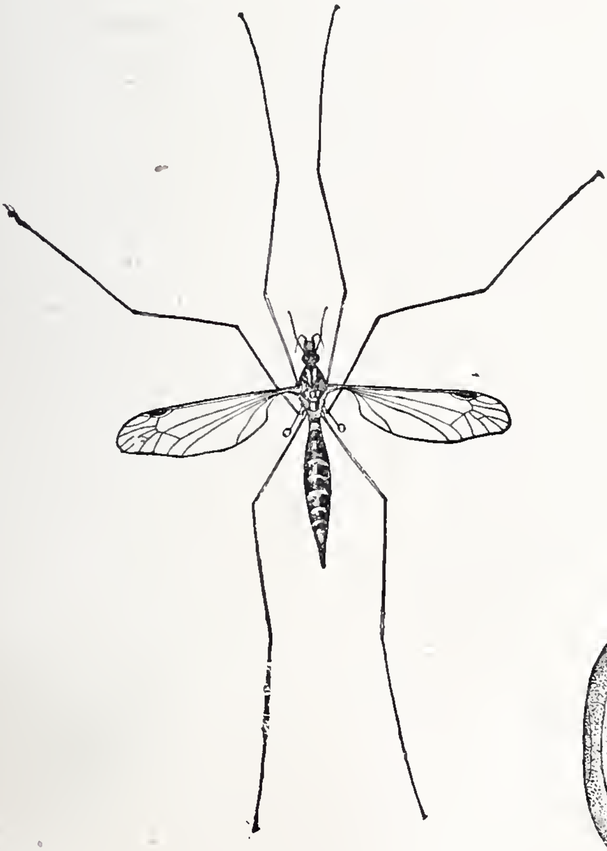
PLATE II.



1

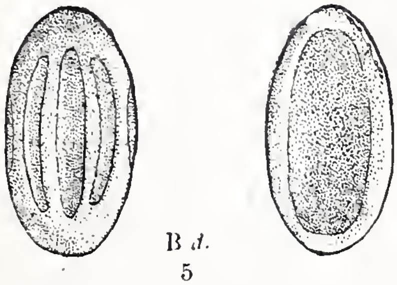


2



3

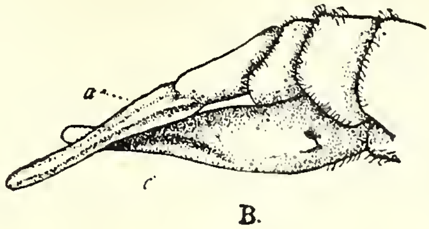
4



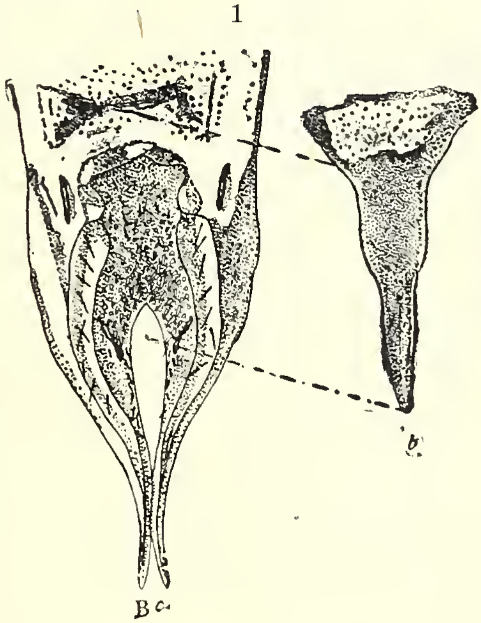
5

6

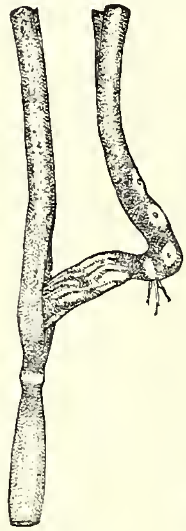
PLATE III.



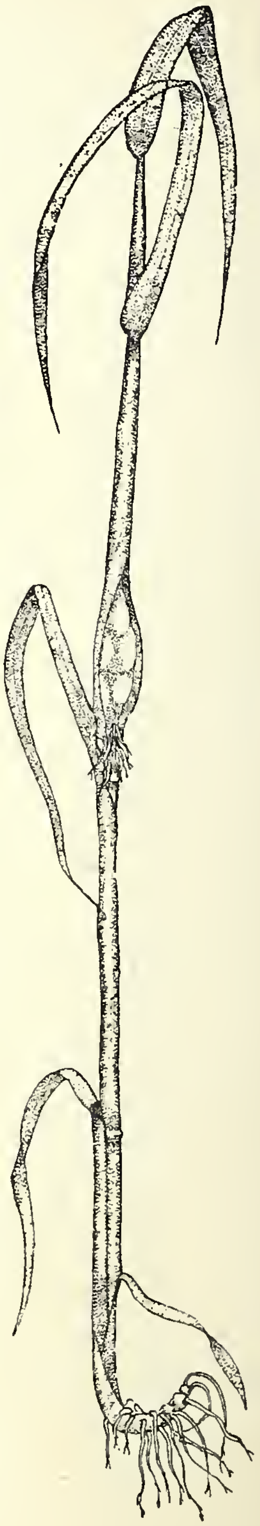
1



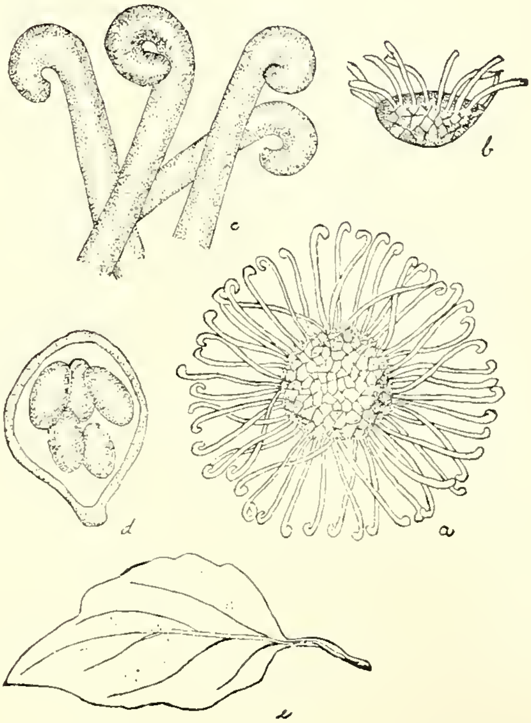
2



4



3



5

ARTICLE XIV—ADDITIONS TO THE PRELIMINARY LIST OF THE UREDINEÆ OF OHIO.

By Freda Detmers.

In Bulletin No. 44, September, 1892, was published a preliminary list of the *Uredineæ* or so-called Rusts of Ohio. This list, as is stated in the Bulletin, is a very short and incomplete one. Since its publication a number of additional species of Uredineæ have been collected in the state; the species given in the list have been found on additional hosts; and the species on the hosts already reported have heen recorded for additional localities. It is therefore the purpose of this second paper to give a list of these additional species, hosts and localities.

In the first list the species were arranged alphabetically under their respective genera. In this second one I have followed the arrangement adopted by Saccardo in his Sylloge Fungorum, vol. VII; and whereas in the former list the nomenclature adopted by Professor T. J. Burrill in his Parasitic Fungi of Illinois, was followed, in the present paper Saccardo's nomenclature has been adhered to. This necessitates a partial revision of the former list, as many names have been changed, some single species have been separated into two or more; and in some cases, species formerly allowed to remain in genera as Aecidium, Roestelia, etc., which are considered incomplete, have been referred to genera having teleutosporic forms. A separate list has been made of these species in which any one of these changes was made; and the old name is printed in italics and enclosed in parenthesis to denote that it is regarded as a synonym. There are then four lists, or more correctly stated, one list divided into four sections. Section first contains the species not given in the former list, the additional species; section second, the species which have been found on hosts other than those already reported, the species on additional hosts; section third, the species which have already been reported on certain hosts from certain localities, but have been found in other, additional localities; section fourth, a list of the changes made necessary by the changes in nomenclature.

Professor W. A. Kellerman of the Ohio State University kindly placed at my disposal his collection of Uredineæ; the very great aid thus given me I gratefully acknowledge. I would also thank Professor A. D. Selby for the many specimens he loaned me; and Mr. W. C. Werner for aid in identifying hosts.

ADDITIONAL SPECIES.

UREDINEÆ.

Amerosporæ.

UROMYCES GERANII (DC.) Otth.

On *Geranium maculatum*, Georgesville, Franklin Co., May 7, 1892, W. A. Kellerman.

UROMYCES HYPERICI (Schw.) Curt.

On *Hypericum perforatum*, Amanda, Fairfield Co., August 30, 1892, W. A. Kellerman; on *H. mutilum*, Lancaster, Fairfield Co., Oct. 10, 1892, W. A. Kellerman.

MELAMPSORA FARINOSA (Pers.) Shroet. (*M. salicina*, Lév.)

On *Salix* sp., Columbus, Oct. 1888, C. M. Weed, Moses Craig; on *S. fragilis* var. *russeliana*, Columbus, Nov. 1, 1890, Freda Detmers.

MELAMPSORA HYDRANGEÆ, Farl.

On *Hydrangea arborescens*, Sugar Grove, Fairfield Co., Sept. 26, 1891, W. A. Kellerman; Rendville, Perry Co., Oct. 24, 1891, W. A. Kellerman. This species is not given in Saccardo. The affected leaves are marked by dark brown or blackish irregular spots or areas which extend from the margin of the leaf towards the midrib. The leaf has a dried and dead appearance.

Didymosporæ.

PUCCINIA CORONATA, Corda.

On volunteer oats, Rendville, Perry Co., Oct. 24, 1892, W. A. Kellerman. Not common in the state.

PUCCINIA ARGENTATA (Schultz) Wint. (*P. nolitangeris*, Cda.)

On *Impatiens fulva*, Sugar Grove, Fairfield Co., Sept. 26, 1891, W. A. Kellerman.

The uredospores are for the most part irregularly oblong. Winter gives the measurement as varying from 15–19mmm. I find spores 30.6x16mmm. not uncommon. The teleutospores evidently arise from the same sori as the uredospores; for although the specimens examined are in the uredo stage, I found a single teleutospore in a uredosorus. This teleutospore measured 27x23.8mmm.

PUCCINIA FUSCA, Relhan. (*P. Anemones*, Pers.)

On *Anemone nemorosa*, Georgesville, Franklin Co., May 11, 1892, Freda Detmers; Lima, May 21, 1892, W. A. Kellerman.

PUCCINIA TENUIS, Burrill. (*Aecidium tenue*, Schw).
Aecidial stage on *Eupatorium ageratoides*, Lancaster, Fairfield Co., June 23, 1883, W. A. Kellerman.

PUCCINIA FERGUSSONII, Berk. var. HASTATÆ. (*P. hastata*, Cooke.)
On *Viola hastata*, Lancaster, Fairfield Co., May 20, 1883, W. A. Kellerman.

PUCCINIA ANEMONES-VIRGINIANÆ, Schw.
On *Anemone Virginiana*, Lancaster, Fairfield Co., July 23, 1883, W. A. Kellerman; Scioto R., May 23, 1892, A. D.Selby.

PUCCINIA SILPHII, Schw.
On *Silphium perfoliatum*, Columbus, June 30, 1892, W. A. Kellerman.

GYMNOSPORANGIUM CLAVARIFORMÆ (Jacq.) Rees. (*Roestelia penecillata*, Fr.)
Roestelia on *Cratægus Crus-galli*, Georgesville, Franklin Co., Sept. 24, 1892, W. C. Werner, on *C. coccinea*, Ash Cave, Hocking Co., Aug. 21, 1892, W. A. Kellerman.

GYMNOSPORANGIUM GLOBOSUM, Farl.
On *Juniperus Virginiana*, Amanda, Fairfield Co., May 1892, W. A. Kellerman.

GYMNOSPORANGIUM BISEPTATUM, Ellis. (*Roestelia Amelanchieris*, Mer.)
Roestelia on *Amelanchier* sp., Mineral Springs, Adams Co., Sept. 10, 1892, W. A. Kellerman.

GYMNOSPORANGIUM CLAVIPES, Cooke et Peck. (*Roestelia aurantiaca*, Peck.)
Spermagonia only of Roestelia on *Cratægus tomentosa* var *punctata* Cedar Hill, May 10, 1892, W. A. Kellerman.

Phragmosporæ.

PHRAGMIDIUM POTENTILLÆ (Pers.) Karst.
On *Potentilla Canadensis*, Lancaster, Fairfield Co., June 20, 1879; Columbus, July 12, 1892, W. A. Kellerman.

COLEOSPORIUM SENECIONIS (Pers.) Fr. (*Aecidium Pini*, Pers.)
On *Pinus rigidus*, Sugar Grove, Fairfield Co., May 21, 1891, Freda Detmers; May 30, 1892, W. A. Kellerman; Morgan Station, June 4, 1892, H. Beatty. Very abundant. At Sugar Grove the needles of the pines are covered with the aecidia.

Dictyosporæ.

RAVENELIA GLANDULIFORMIS, B. et C.
On *Tephrosia Virginiana*, Fairfield Co., June 1893, W. A. Kellerman.

UREDINEÆ INFERIORES.

AECIDIUM CIMICIFUGATUM, Schw.
On *Cimicifuga racemosa*, Ironton, May 27, 1892, W. C. Werner; Sugar Grove, Fairfield Co., May 30, 1892, W. A. Kellerman.
The specimens of Rusts on *Cimicifuga racemosa* placed in the former list under *Ae. Actææ* should be referred to this species:

AECIDIUM DICENTRÆ, Trel.
On *Dicentra cucullaria*, Central College, Franklin Co., May 28, 1892, W. A. Kellerman. Rare.

AECIDIUM NESÆÆ, Gerard.
On *Decodon verticillatus*, Cranberry Swamp, Licking Reservoir, June 29, 1892, A. D. Selby.

AECIDIUM SAMBUCI, Schw.
On *Sambucus Canadensis*, Central College, Franklin Co., May 28, 1892; Amanda, Fairfield Co., July 2, 1892, W. A. Kellerman.

AECIDIUM COMPOSITARUM, Mart. var HELIANTHI, Burrill.
On *Helianthus divaricatus*, Ironton, May 27, 1892, W. C. Werner.

UREDO AGRIMONIÆ (DC.) Schroet.
On *Agrimonia Eupatoria*, Fairfield Co., Oct. 20, 1882, July 18, 1892, W. A. Kellerman; on *Agrimonia* sp., Sugar Grove, Fairfield Co., Nov. 5, 1892, A. D. Selby.

UREDO HYDRANGEÆ, Berk et Curt.
On *Hydrangea arborescens*, Athens, Athens Co; Aug. 11, 1892, W. A. Kellerman. This is very likely the uredo stage of *Melampsora Hydrangeæ* Farl.

ADDITIONAL HOSTS.

UREDINEÆ.

Amerosporæ.

UROMYCES LESPEDEZÆ (Schw,) Peck.

On *Lespedeza polystachya*, Sugar Grove, Fairfield Co., Sept. 3, 1892, W. C. Werner; on *L. repens*, Sugar Grove, Fairfield Co., Sept. 26, 1891, W. A. Kellerman.

UROMYCES HEDYSARI-PANICULATI (Schw.) Farl.

On *Desmodium Dillenii*, Georgesville, Franklin Co., Sept. 24, 1892, W. C. Werner, Sept. 28, 1892, A. D. Selby; on *Desmodium* sp., Cedar Swamp, Champaign Co., Sept. 10, 1892, W. C. Werner; Bloomville, Hocking Co., Aug. 30, 1892, W. A. Kellerman.

UROMYCES EUPHORBIÆ, Cooke et Peck.

On *Euphorbia maculata*, Akron, Sept. 4, 1892. E. W. Claypole.

UROMYCES HOWEI, Peck.

On *Asclepias* (not identified) in greenhouse. Columbus, O. S. U., Oct. 1891, W. A. Kellerman.

MELAMPSORA POPULINA, Lév.

On *Populus balsamifera* var. *candicans*, near railroad, Stockport, Morgan Co., Feb. 21, 1892, W. A. Kellerman.

Didymosporæ.

PUCCINIA MENTHÆ, Pers.

On *Pycnanthemum linifolium*, Amanda, Fairfield Co., July 30, 1892, W. A. Kellerman.

PUCCINIA ANGUSTATA, Peck.

On *Carex riparia*, Amanda, Fairfield, Co., Dec. 25, 1891, W. A. Kellerman; on *Scirpus* sp., Amanda, Fairfield Co., Dec. 25, 1891, W. A. Kellerman.

PUCCINIA ANDROPOGONIS, Schw.

On *Andropogon scoparius*, Amanda, Fairfield Co., Oct 1, 1892, W. A. Kellerman. A splendid example of irregular spores. Three celled spores are frequent, in some instances the upper cell is divided by a diagonal septum in place of a horizontal one. Four celled spores are not uncommon. The spores are often much curved.

PUCCINIA XANTHII, Schw.
On *Ambrosia trifida*, Athens, Athens Co., Aug. 11, 1892. W. A. Kellerman.

GYMNOSPORANGIUM MACROPUS, Link (*Roestelia pirata* (Schw.) Thaxter.)
Roestelia on *Pirus coronaria* Amanda, Fairfield Co., July 20, 1892, W. A. Kellerman.

ADDITIONAL LOCALITIES.

UREDINEÆ.

Amerosporæ.

UROMYCES POLYGONI (Pers.) Fckl.
On *Polygonum erectum*, Amesville, Athens Co., Sept. 8, 1892, A. D. Selby.

UROMYCES TRIFOLII (Hedw.) Lév.
On *Trifolium pratense*, Sugar Grove, Fairfield Co., Sept. 24, 1891, W. A. Kellerman; on old leaves of *T. pratense*, Columbus, Jan. 1892, W. A. Kellerman.

UROMYCES CALADII (Schw.) Farl.
On *Arisæma triphyllum*, Ironton, May 27, 1892, W. C. Werner; Granville, Licking Co., May 29, 1892, C. J. Herrick; on *Arisæma Dracontium*, Black Lick, Franklin Co., May 14, 1892, Ironton, May 27, 1892, W. C. Werner; Central College, Franklin Co., May 28, 1892, W. A. Kellerman.

UROMYCES LESPEDEZÆ (Schw.) Peck.
On *Lespedeza reticulata*, Otway, Scioto Co., Sept. 9, 1892, W. A. Kellerman; on *Lepedeza violacea*, Georgesville, Franklin Co., Sept. 24, 1892, A. D. Selby.

UROMYCES HEDYSARI-PANICULATI (Schw.) Farl.
On *Desmodium canescens*, Mineral Springs, Adams Co., Sept. 10, 1892, W. A. Kellerman.

UROMYCES HOWEI, Peck.
On *Asclepias Cornuti*, Athens, Athens Co., Aug. 11, 1892, W. A. Kellerman; Cedar Swamp, Champaign Co., Sept. 10, 1892, W. C. Werner; Waynesville, Warren Co., Oct. 15, 1892, W. A. Kellerman.

MELAMPSORA POPULINA (Jacq.) Lév.
On *Populus monilifera*, Scioto R., Sept. 7, 1892, A. D. Selby.

Didymosporæ.

PUCCINIA VIOLÆ (Schum.) DC.
On *Viola palmata*, Wyandotte Grove, Franklin Co., June 29, 1892, A. D. Selby.

PUCCINIA MENTHÆ, Pers.
On *Blephilia hirsuta*, Lancaster, Fairfield Co., July 5, 1883, W. A. Kellerman.

PUCCINIA RUBIGO-VERA (DC.) Wint.
On wheat, Lancaster, Fairfield Co., July 5, 1883, W. A. Kellerman. Is not so common throughout the state as *P. graminis*.

PUCCINIA ANGUSTATA, Peck.
On *Scirpus fluviatilis*, Amanda, Fairfield Co., Dec. 25, 1891, W. A. Kellerman.

PUCCINIA EMACULATA, Schw.
On *Panicum capillare*, Amanda, Fairfield Co., Dec. 29, 1891; Stockport, Morgan Co., Feb. 21, 1892, W. A. Kellerman.

PUCCINIA PODOPHYLLI, Schw.
On *Podophyllum peltatum*, Cincinnati, May 7, 1891, C. J. Herrick (the specimen is from the Herbarium of Dennison University); Lima, May 21, 1892, W. A. Kellerman; Ironton, May 27, 1892, W. C. Werner; Central College, Franklin Co., May 28, 1892; Nebraska, Fairfield Co., June 11, 1892, W. A. Kellerman; Wyandotte Grove, Franklin Co., June 29, 1892, A. D. Selby.

PUCCINIA CIRCÆÆ, Pers.
On *Circæa Lutetiana*, Lancaster, Fairfield Co., June 20, 1879; Columbus, June 28. 1892; Amanda, Fairfield Co., July 2, 1892; Sugar Grove, Fairfield Co., Aug. 6, 1892; Athens, Athens Co., Aug. 11, 1892, W. A. Kellerman.

PUCCINIA XANTHII, Schw.
On *Xanthium Canadensis*, Mineral Springs, Adams Co., Sept. 10, 1892, W. A. Kellerman.

GYMNOSPORANGIUM MACROPUS, Link.
On *Juniperus Virginianum*, Amanda, Fairfield Co., May 14, 1892, W. A. Kellerman.

UREDINEÆ INFERIORES.

AECIDIUM RANUNCULI, Schw.
On *Ranunculus abortivus*, Georgesville, Franklin Co., May 7, 1892, W. A. Kellerman.

AECIDIUM IMPATIENTIS, Schw.
On *Impatiens* sp., Nebraska, Fairfield, Co., June 11, 1892; Athens, Athens Co., Aug. 11, 1892, W. A. Kellerman.

AECIDIUM OENOTHERÆ, Peck.
On *Oenothera biennis*, Fairfield Co., May 30, 1883, May 14, 1892, W. A. Kellerman.

AECIDIUM GROSSULARIÆ, Schum.
On *Ribes Cynosbati*, Lima, Allen Co., May 21, 1892, W. A. Kellerman; Akron, June 3, 1892, W. C. Werner.

AECIDIUM COMPOSITARUM, Mart.
On Solidago, Lancaster, Fairfield Co., June 10, 1883, W. A. Kellerman.

AECIDIUM ERIGERONATUM, Schw.
On *Erigeron annuus*, Nebraska, June 11, 1892, W. A. Kellerman.

AECIDIUM PUSTULATUM, Curt.
On *Comandra umbellata*, Georgesville, Franklin Co., May 9, 1891, A. D. Selby; May 7, 1892, W. A. Kellerman.

SPECIES WHICH WERE REPORTED IN THE PREVIOUS LIST, WHOSE NAMES HAVE BEEN CHANGED.

The names formerly used are written as synomyms; there are also given the additional hosts on which and localities in which they have been collected.

UREDINEÆ.

Amerosporæ.

UROMYCES TEREBINTHI (DC.) Wint. (*Pileolaria brevipes*, Berk. et Rav.)
On *Rhus Toxicodendron*, Lancaster, Oct. 1, 1892, W. A. Kellerman.

Didymosporæ.

PUCCINIA GALII (Pers.) Schw. (*P. Galiorum*, Lk.)
On *Galium Aparine*, Georgesville, Franklin Co., Oct. 10, 1891, E. E. Bogue; on *G. concinnum*, Georgesville, Franklin Co., Sept. 24, 1892, W. C. Werner; Rendville, Perry Co., Oct. 24, 1891, W. A. Kellerman.

PUCCINIA HELIANTHI, Schw. (Included under *P. Tanaceti* in Parasitic Fungi of Ill. Burrill.)

On *Helianthus decapetalus*, Bloomville, Hocking Co., Aug. 30, 1892, W. A. Kellerman; on *H. hirsutus*, Amanda, Fairfield Co., Oct. 1, 1892, W. A. Kellerman.

PUCCINIA HIERACII (Schum.) Mart. (*P. flosculosorum*, Roehl.)

On *Taraxacum officinale*, Central College, Franklin Co., May 28, 1892, A. D. Selby.

PUCCINIA SORGHI, Schw. (*P. Maydis*, Carradorri.)

On corn leaves, Mineral Springs, Adams Co., Sept. 10. 1892; Waynesville, Warren Co., Oct. 15, 1892, W. A. Kellerman; on sorghum leaves, Laurelville, Hocking Co., Aug. 30, 1892, W. A. Kellerman.

PUCCINIA SMILACIS, Schw. (*Uredo Smilacis*, Schw.)

On *Smilax rotundifolia*, Lancaster, Fairfield Co., Oct. 20, 1882, W. A. Kellerman.

PUCCINIA SPRETA, Peck. (*P. Tiarellæ*, B. et. C.)

On *Mitella diphylla*, Rendville, Perry Co., Oct. 24, 1891, W. A. Kellerman.

Phragmosporæ.

PHRAGMIDIUM SUBCORTICUM (Schrank,) Wint. (*Ph. mucronatum*, Schum.) (*Coleosporium miniatum* (Pers.) Fckl.)

On *Rosa lucida*, Lancaster, Fairfield Co., June 15, 1883, W. A. Kellerman; on *Rosa* sp., Georgesville, Franklin Co. May 7, 1892, W. A. Kellerman, A. D. Selby; Ironton, Lawrence Co., May 27, 1892. W. C. Werner.

COLEOSPORIUM SONCHI (Pers.) Lév. (*Co. Compositarum* Lév.)

On *Helianthus doronocoides*, Lancaster, Fairfield Co., Sept. 26, 1882 on *Aster miser*, Lancaster, Sept. 28, 1882, W. A. Kellerman.

COLEOSPORIUM VERNONIÆ, B. et. C. Placed under *Co. Sonchi-arvensis* in previous list.

On *Vernonia* sp., Otway, Scioto Co., W. A. Kellerman.

COLEOSPORIUM SOLIDAGINIS (Schw.) Thüm. Placed under *Co, Sonchi-arvensis* in previous lists.

On *Solidago cæsia* and *S.* sp., Sugar Grove, Fairfield Co., Sept. 26, 1891; on *S. Canadensis* and *S. latifolia*, Rendville, Perry Co,, Oct. 24, 1891, W. A. Kellerman.

UREDINEÆ INFERIORES.

UREDO POLYPODII (Pers.) DC. (*U. filicum*, Desm.)

On *Cystopteris fragilis*, Lancaster, Fairfield Co., July 16, 1883, W. A. Kellerman.

UREDO (CÆOMA) NITENS, Schw. (*Cæoma nitens*, Schw.) *Cæoma luminiatum*, Schw.)

Aecidia on *Rubus villosus*, Lancaster, Fairfield Co., June 20, 1879, May 15, June 5, 1883; Georgesville Franklin Co.; May 7, 1892, W. A. Kellerman; Sugar Grove, Fairfield Co., May 14, 1892, A. D. Selby; Black Lick, Franklin Co., May 14, 1892, E. E. Bogue; Amanda, Fairfield Co., May 14, 1892, Sugar Grove, Fairfield Co., May 30, 1892; Central College, Franklin Co., May 28, 1892; Nebraska, June 11, 1892, W. A. Kellerman; on Raspberry, Lima, May 27, 1892, W. A. Kellerman. Aecidia and uredo stages on *Rubus villosus* (Blackberry), Sugar Grove, Fairfield Co., Sept. 26, 1891; Rendville Perry Co., Oct. 24, 1891; on Dewberry, Sugar Grove, Fairfield Co., Sept. 26, 1891, W. A. Kellerman. This rust seems to be extremely abundant throughout the state, wherever a Rubus grows. The uredo sori on the Blackberry and Dewberry are not fully developed, the spores are very pale, almost colorless and are still firmly attached to their pedecils. They average 17–23x14–20mmm. Fully developed uredospores collected Nov. 1, 1891, on a Blackberry at Rock Mills Fairfield Co., average 22–32.6x16–22mmm. These spores are bright yellow, obovate, or pear shaped, wall thin, minutely echinulate. There are no paraphyses. This may be the Uredo stage of *Puccinia Peckiana* to which *Cæoma nitens* is thought to belong. I can find no descripton of the uredo stage of *P. Peckiana*.

ARTICLE XV.—BIBLIOGRAPHY OF OHIO BOTANY.

BY W. A. KELLERMAN, OHIO STATE UNIVERSITY.

The list of articles here given in chronological order includes only such as refer particularly to plants that occur in Ohio.

All state and local catalogues or lists are included, also all articles dealing with native plants of Ohio—whether a single plant only or many plants are mentioned.

Purely physiological and morphological papers have been excluded. Teratological notes or papers, however, are included.

It was not the purpose to make a List of Publications by Ohio botanists, amateurs and collectors (which would, had that been undertaken, have occupied many more pages than the present paper covers). The object was to bring together for convenient reference such and such only as referred especially to Ohio botany.

Notices of any omissions will be thankfully received.

1815.

Forest of the Miami Country, and plants useful in medicine and the arts. In Natural and Statistical View or picture of Cincinnati and the Miami Country. By Daniel Drake, Cincinnati.

A volume of 255 pages, of which pp. 76–90, inclusive, are devoted to botany. Here nothing farther was "attempted than a catalogue of the forest trees, and such herbaceous plants as are deemed useful in medicine and the arts." Under the head of "Forests of the Miami Country" is given, alphabetically arranged in three columns (the first headed "Families," the second "Species," and third "Popular Name"), a list of one hundred species belonging to about sixty genera, and several undetermined species of the genera Prunus, Crataegus, Mespilus, and Smilax. A long note is given on the species of Aesculus—Ae. flava, L. & Ae. maxima, n. sp.—presumably mistaken for Ae. glabra, Willd. & Ae flava· The second sub-head is "Plants Useful in Medicine and the Arts." These are arranged alphabetically under the heads of "Stimulants" (thirteen species), "Tonics" (eight species), "Astringents" (seven species), "Emetics" (nine species), "Cathartics" (six species), "Diuretics" (three species), "Anthelmintics" (three species), "Demulcents" (two species), and "Plants used in Dyeing and the Domestic Arts" (fifteen species). The botanical name, the common name, and the part of the plant used are given in each case. The third and last section is "Calendar of Flora." "Most of the dates given are the mean terms of several years' observation." Thirty-four entries are made, beginning with March 5th, "commons becoming green," and ending with Oct. 30th, "woods leafless."

1818.

Notice of the Scenery, Geology, Mineralogy, Botany, etc., of Belmont county, Ohio, by Caleb Atwater, Esq., of Circleville. American Journal of Science (Silliman's Journal), 1818, Vol. I, p. 226.

Two pages (228–9) of this article are devoted to botany. Thirty trees are enumerated in tabular form, and a few others, including some shrubs and herbaceous plants, are noted. The uses of a few of them are given.

1831.

Notices of Western Botany and Conchology, by C. W. Short, M. D., and H. H. Eaton, A. M. Transylvania Journal of Medicine and the associated sciences. Vol. IX, 1831, p. 69.

An annotated list (pp. 70–73) of fifty species of plants noticed in bloom the preceding fall, on a trip (Sept. 16th to Oct. 1st) from Lexington, Ky., to the southern portion of Ohio (vicinity of Cincinnati). Many of the plants were found on the banks of the Ohio River.

1834.

A Catalogue of Plants growing spontaneously in Franklin Co., Central Ohio, excluding grasses, mosses, lichens, fungi, etc. By John L. Riddell, A. M. The Western Medical Gazette, Vol. II, No. 3, July, 1834, pp. 116–120.

The plants enumerated (317 species) are "arranged under the natural orders approved by Prof. Lindley." Those not native, but naturalized, are marked with a star. The habitats are given for most of the species. The plants were collected during the autumn of 1832, and the spring, summer and autumn of 1833.

1835.

Synopsis of the Flora of the Western States, by John L. Riddell' Western Journal of the Medical and Physical Sciences. Vol. VII, No. XXXI (Second Hexade, Vol. II, No. III), Jan., 1835, pp. 329–374; No. XXXII (Second Hexade, Vol. II, No. IV), April, 1835, pp. 489–556.

The region to which this synopsis or catalogue is intended to apply, "embraces Ohio, Indiana, Illinois, Kentucky, West Tennessee, and Missouri, a small part of Virginia and Pennsylvania, and of the Michigan, Northwest and Missouri territories." The plants of Ohio, unless otherwise accredited, have been personally observed and collected by the writer (John L. Riddell). "The philosophic method of Prof. Lindley is observed in the arrangement." The species are numbered serially, and include flowering plants (1–1724); equiseta (1725–1731); ferns (1732–1769); lycopodacca (1770–1774); mosses (1776–1785); hepaticae (1786–1789); characeae (1790–1794); and lichenes (1795–1802). The list is preceded by four pages of prefatory remarks, and followed by an index to the genera, of four pages. Stations are given, and time of flowering, color of flower, height of plant, duration of existence (by signs) and the habitats.

1836.

Supplementary Catalogue of Ohio Plants, embracing the species discovered within the state of Ohio in 1835, catalogue and descriptions read and specimens exhibited before the Western Academy of Natural Sciences, March 16, 1836, by John L. Riddell, M. D. Western Journal of the Medical and Physical Sciences, Vol. IX, No. XXXVI (Second Hexade, Vol. III., No. IV), April, 1836, pp. 567–592.

The list contains 170 species, mostly flowering plants and ferns (three Lycopods, two Mosses, and one Liverwort), with localities and stations, general remarks as to size, etc., and a full description of the new species.

1840.

A Catalogue of Plants, native or naturalized, in the vicinity of Columbus, Ohio, by Wm. S. Sullivant, 1840.

A pamphlet of sixty-two pages, giving a mere list of plants which Sullivant collected in Franklin Co. He says, "The collections here listed may be taken, I think, as a tolerably fair representation of the phaenogamous flora of the central parts of this state; nearly all localities, apparently indicating a peculiar vegetation, have been visited." The list (pp. 5–55) contains 779 plants. Seven pages of notes on several species follows the list.

1841.

Florula Lancastriensis, or a Catalogue comprising nearly all the flowering and filicoid plants growing naturally within the limits of Fairfield county, with notes of such as are of medical value, by J. M. Bigelow. Proceedings of Medical Convention of Ohio at Columbus, May, 1841.

Not seen; title from Britton's State and Local Floras.

Florula Lancastriensis: A catalogue of the plants of Fairfield county, by John M. Bigelow and Asa Hor, Lancaster, 1841. A pamphlet of twenty-two pages.

Not seen; title from Britton's State and Local Floras.

1849.

Catalogue of Plants, native and naturalized, collected in the vicinity of Cincinnati, Ohio, during the years 1834–1844, by Thos. G. Lea, Philadelphia, 1849.*

The list is preceded by a "notice" (p. ii.) by Isaac Lea (brother of Thos. G. Lea), who states that the MS. and herbarium were placed in the hands of W. S. Sullivant, who determined the phenogams, mosses and hepaticæ. Edw. Tuckerman identified the lichens, and M. J. Berkley the fungi. Notes and descriptions by the latter are given as foot-notes. The arrangement is according to the natural system. There are enumerated about 698 species of phenogams, nineteen ferns, two equisetaceae, eighty-nine musci, sixty-eight lichens (of which four were new to science) and about 320 fungi (of which about fifty were new), making in all nearly 1,050 species.

---

*We are indebted for summary of contents to Mr. Davis L. James, to whom we extend thanks for this and other favors.

List of the medicinal plants of Ohio, with brief account of their properties, by John M. Bigelow, M. D., Columbus, Ohio, 1849.

Pamphlet of forty-seven pages. Not seen; given in Britton's State and Local Floras. Torrey Bulletin; X. 104.

1852.

Catalogue of Flowering Plants and Ferns observed in the vicinity of Cincinnati, by Joseph Clark. Adopted and published by the Western Academy of Natural Sciences, Cincinnati, 1852.

Pamphlet of thirty pages. The list—preceded only by a list of the officers and curators of the academy, there being no preface—embraces the plants "observed growing in a compass of about six miles around Cincinnati." In a foot-note the author says, "Some of them cannot be found in the circuit * * * * but they were all found as above indicated, within the last fifteen years," The genera of the flowering plants and ferns (Chara flexilis also included) are arranged alphabetically, and the orders are not indicated. No varieties as such are recognized. Six hundred and one species are given, and in an Addenda, by Robert Buchanan, ninety-five more are given, or a total of 696 species.

1853.

The Grasses of Wisconsin and the adjacent States of Iowa, Illinois, Indiana, Ohio and Michigan, and the territory of Minnesota and the region about Lake Superior, by I. A. Lampham. Trans. Wis. State, Agr. Soc. III, 397–488, 1853.

Not seen; title from Britton's Local Floras of the United States.

1858.

List of the Grasses found in Ohio, by John H. Klippart. Twelfth Annual Report of the Ohio State Board of Agriculture, 1859. Columbus, 1858, p. 37.

This compiled list includes both the native and cultivated grasses, and gives, in tabular form, the scientific name, common name, place where found, condition (wild or cultivated), and flowering time. It covers three pages, and enumerates 105 species.

1859.

Catalogue of the Flowering Plants and Ferns of Ohio, by J. S. Newberry, M. D. Ohio Agricultural Report for 1859, pp. 135–273.

This is "the first effort toward the formation of a complete flora of the state." The list of plants is preceded by a general discussion of the "influences which have determined the distribution of species" over the state, pp. 235–241; and a list of the sources from which the catalogue was compiled, as follows: Catalogue of the plants of Frauklin county, by W. Sullivant; catalogue of the plants of Fairfield county, by Drs. Bigelow and Hor; catalogue of the plants of Cincinnati, by Thos. G. Lea; catalogue of the plants of Cincinnati, by Joseph Clark; synopsis of the flora of the Western States, by J. L. Riddell; MS. catalogue of plants in Summit and Cuyahoga counties, by the author.

Localities, as "general," "western," "southern," etc., are given for all species or particular localities for rarer plants. The catalogue includes 1341 species and varieties of flowering plants, and fifty-three vascular cryptograms, or a total of 1394. At this place should, perhaps, be noted the statement of J. H. Klippart, prefixed to the Beardslee Catalogue, which was published in the Ohio Agricultural Report for 1877, to the effect that he, in conjunction with a few others, collected plants and obtained local lists by others, and by this means prepared a catalogue of plants of Ohio, which was submitted to Dr. Newberry for suggestion and correction, and that the latter returned for publication not the original manuscript, but that published whose title is given above.

1860.

List of the Native Forest Trees of Ohio. By John A. Klippart. Ohio Agricultural Report, 1860, pp. 277-8.

This list is appended to Mr. Klippart's article on "Forests, their influence upon Soil and climate", covers two pages, enumerating in tabular form one hundred and seven trees (including both species and varieties, also a few of the larger shrubs) gives the botanical names, the popular names, height in feet, and where (in the State) most abundant.

1865.

Catalogue of Plants Contained in Herbarium of Joseph Clark. By Rachel L. Bodley. Not published. Cincinnati, 1865.

In this printed pamphlet the Cincinnati plants are starred, and number six hundred and seventeen phenogams, and twenty-three ferns.

1872.

List of Trees Found Growing Indigenously in Ohio. By John Hussey. Twenty-seventh Annual Report of the Ohio State Board of Agriculture for 1872. Columbus 1873, pp. 32-40, The list contains both the trees and shrubs, of which two hundred and twenty-seven are enumerated. Localities are given for many of the species, and in several cases notes are added.

1874.

Catalogue of the Plants of Ohio including Flowering Plants, Ferns, Mosses, and Liverworts. By H. C. Beardslee. Painesville, Ohio, January, 1874. Pamphlet of nineteen pages. Reprinted in Ohio Agricultural Report, 1877, pp. 346-363.

Dr. Beardslee prepared in the fall of 1873 a catalogue of Ohio plants for publication in the Geological Survey of the State. This list is a condensation of that catalogue, giving "merely a list of genera and species with localities." He reports, including both species and varieties, one thousand one hundred and seventeen Exogens, four hundred and twenty-nine Endogens, and three hundred and eighty-two Acrogens: total one thousand, nine hundred and twenty-eight. Or rearranging the summary, there are one thousand five hundred and forty-six phenogams, seventy-one vascular cryptogams, two hundred and sixty-one mosses, and fifty hepaticæ.

Report on the Geology of Delaware County. By N. H. Winchell. Report of the Geological Survey of Ohio, 1874. Vol. I, Part I. Geology, p. 272. (Trees, etc., p. 274.)

Of this report two pages (pp. 274-5) are devoted to a list of "Trees, Shrubs, and hardy vines found growing in Delaware County)" furnished by Rev. J. H. Creighton. It is a list comprising the scientific names of one hundred and twenty-two species.

Report on the Geological Survey of Ohio, 1874. Vol. I, p. 415 (Trees p. 416.)

A list of twenty-nine trees which are "characteristic of the county" is given, both the scientific and common names being used.

The Geology of Defiance County. By N. H. Winchell. In report of the Geological Survey of Ohio, 1874, Vol. I, p. 422 (Trees p. 424.)

"In the survey of the county, the following species of trees were noted" namely a list (including scientific and common names) of forty-three species.

1875.

Note from Painesville, Ohio. By H. C. Beardslee. Bulletin of the Torrey Botanical Club. Vol. VI. No. 2, 1875, p. 16.

Notices viviparous species of Scirpus, and occurrence of Fissidens hyalinus, Amarantus Blitum, and Hydrodictyon utriculatum.

1876.

Some interesting Cryptogams found near Painesville (H. C. Beardslee) Botanical Bulletin (Gazette), Vol. I, No. 3. January, 1876, p. 12.

Discelium nudum found in 1872; Fissidens hyalinus, 1873; Riccia Frostii in 1874.

List of Hepaticæ growing in Ohio. Dr. H. C. Beardslee, Painesville, Ohio. Botanical Bulletin (Gazette) Vol. 1. No. 6, April, 1876, p. 22.

A list, without stations, of sixty species and varieties.

Forest Trees of the United States, Centennial Collection (Vasey.) Ohio Trees (Klippart), Ohio Agricultural Report, 1876. 354-388.

This is a reprint of a Report by Dr. Vasey to the Commissioner of Agriculture, and Mr. J. H. Klippart added the word "Ohio" to such as occur in this state.

A peculiar form of Ragweed, Ambrosia artemisiaefolia. By Joseph F. James; Botanical Gazette. Vol. 1, No. 2. Dec. 1876, p. 63.

Specimens found at Loveland, Ohio, with no sterile flowers, but fertile flowers in upright spikes.

1877.

Wolffia (mode of reproduction.) By H. C. Beardslee. Botanical Gazette, Vol. 1, No. 6, April, 1877, p. 99.

Indentation and finally fission of the frond.

Camptosorus rhizophyllus (Miss H. J. Biddlecome), Botanical Gazette, Vol. 1, No. 6, April, 1877, p. 100.

Prolongation of basal lobe five inches, in two cases the apex had taken root.

Some Hardy Dentarias. By Joseph F. James. Botanical Gazette. Volume. 1, No. 8, June, 1877, p. 115.

Some specimens of Dentaria laciniata not injured by frost.

Some Nymphæas. By H. C. Beardslee. Botanical Gazette, Vol. II, No. 12. October, 1877, p. 144.

Nelumbium luteum at Bass Lake. Nymphæa with pink flowers.

1878.

Flora of the Miami Valley. By A. P. Morgan. Published by the Literary Union, Dayton, Ohio, 1878.

A pamphlet of sixty-eight pages including the Phenogams, Ferns, Mosses, Liverworts, Lichens, and Fungi of Miami, Montgomery, Butler, Warren, and Hamilton Counties.

Botrychium lunarioides var. obliquum. By Mrs. E. J. Spence. Botanical Gazette, Vol. III. No. 4. April, 1878, p. 39.

Specimen with two disconnected, well-developed spikes.

Report of the Geology of Darke County. By A. C. Lindemuth. Second Report of the Geological Survey of Ohio. Vol. III, part I. Geology, 1878, p. 496.

The "most common forest trees noticed" are given (thirty-two in number) both by popular and botanical name (on pp. 511-2).

1879.

Catalogue of the Flowering Plants, Ferns, and Fungi growing in the Vicinity of Cincinnati. By Joseph F. James. Journal of the Cincinnati Society of Natural History, April, 1879; álso separate pp. 1-27.

The author compiled the work from personal observation, and from the catalogues of Messrs. Lea and Clark. Assistance from others is also acknowledged. The list of fungi were "copied bodily from the excellent catalogue of Mr. Lea published in 1849," and a few collected since added. The corrections in nomenclature and orthography were made by Prof. Charles H. Peck. Eight hundred and ninety phenogams and vascular cryptogams (including also Chara flexilis) and three hundred and nineteen fungi are given, or a total of one thousand two hundred and eighteen species and varieties.

Agaricus Morgani Peck. By A. P. Morgan. Botanical Gazette. Vol. IV, No. 9. Sept. 1879, p. 208.

Notes extremely large specimen, largest in the world; mentions color of spores, green.

Notes from Toledo, Ohio. By J. A. Sanford. Botanical Gazette, Vol. IV, No. 10. October, 1879, p. 219.

Mentions Schollera, Solidago, Liatris, Amarantus, Zizania, Cornus, and Lactuca.

1880.

Draba verna, L. and Sisymbrium Thaliana, Gaud. biennial. By H. C. Beardslee. Bulletin of the Torry Botanical Club, Vol. VII, No. 2. February, 1880, p. 43.

Notices of rosettes of radical leaves of three species, Feb. 18, which were found in the previous fall.

Notes from Painesville (H. C. Beardslee). Botanical Gazette, Vol. V, No. 4. April, 1880, p. 43.

Mentions viviparous specimens of Scirpus and Cenchrus and biennial habit of Draba and Sisymbrium.

Teratologay; Carya alba. By H. C. Beardslee. Bulletin of the Torrey Botanicrl Ciub, Vol. VII, No. 5. May, 1880, p. 54.

Notices occurrence of triangular nuts of Carya alba (apparently C. sulcata).

New Stations for rare Plants. By A. P. Morgan. Botanical Gazette, Vol. VII, No. 7. July 1880, p. 79.

Notes occurrence of Botrychium matricariæfolium at Columbus and Veratrum Woodii at Dayton.

1881.

Notices of the Floras of Cincinnati, published from 1815 to 1879 with some additions and corrections to the catalogue of Joseph F. James. By Davis L. James. In the Journal of the Cincinnati Society of Natural History, January, 1881.

The additions and corrections are numbered to correspond to the numbers in Joseph F. James' Catalogue and consist of ninety-three entries.

Nymphæa odorata. By Davis L. James. Botanical Gazette, Vol. VI, No. 9. Sept. 1881, p. 266.

Notes structure of seeds (aril) to secure dispersion of seeds as noticed by Dr. Jonn A. Warder and son at North Bend, Ohio.

Notes from Dayton. By August F. Fœrste. Botanical Gazette, Vol. VI, No. 10. Oct. 1881, p. 274 and Vol. VII, No. 2, Feb. 1882, p. 24.

Gives arrangement of leaves in Conobea multifida and Nesæa verticillata; mentions forked pinnæ in Dicksonia and notes occurrence of Lycoperdon pedicellatum at Dayton.

1882.

Woody Plants of Ohio, arranged under their appropriate Botanical orders with remarks upon their uses, qualities and sources. By Jno. A. Warder, M. D., President American Forestry Association, assisted by Davis L. James and Jos. F. James, of the Cincinnati Society of Natural History. Presented at the meeting of the Agricultural Convention of Ohio, in Columbus, January, 1882.

Pamphlet, pp. 1-40. Brief address to the convention referring to prevailing ignorance as to our native forest trees, explanation of the paper (pp. 2-3), explanatory note to the reader (pp. 3-4), "note" by D. L. J. and J. F. J. p. 4, and Woody Plants of Ohio, pp. 5-40. Native species printed in blackfaced type of which two hundred and sixty-one are enumerated. One hundred and thirty-seven introduced species are mentioned accompanied usually, as are the native species, with brief descriptive notes, printed in small capitals, if foreign plants, and in italics if introduced from other portions of the United States. The paper is mostly a record of Dr. Warder's own observations, though many localities are given on the authority of Beardslee and Newberry.

Teratological Note. By A. F. Fœrste. Botanical Gazette, Vol. VII. No 11. Nos. 8 and 9, Aug. and Sept. 1882, p. 112.

Multiplication of parts in Lathyrus palustris at Dayton.

A New Polyporus. By A. P. Morgan. Botanical Gazette, Vol. VII, No. 11. Nov. 1882, p. 135.

Describes Polyporus reniformis, Morgan, occurring from Dayton to Cincinnati.

Lactuca Scariola, L. By Aug. F. Fœrste. Botanical Gazette, Vol. VII, No. 11. Nov. 1882, p. 137.

Abundant at Dayton, Put-in-Bay etc.; places its vertical leaves so as to point to the poles.

1883.

Mycologic Flora of Miami Valley, by A. P. Morgan, in the Journal of the Cincinnati Society of Natural History, Apr. 1883, Jan. 1888, Vol. VI-XI. Nine numbers as follows: April, July, Oct. (1883), Apr. (1884) July, Oct. (1885), Apr. (1887), Jan. (1888). July, Oct. (1888).

It includes full and original descriptions of Hymenomycetes of all the species found, some of which are new and many are illustrated by colored plates.

Large Rhus Toxicodendron, by Aug. F. Foerste, Botanical Gazette, Vol. VII, No. 6, June, 1883, p. 245.

Specimen at Dayton seventeen inches in circumference.

Chorisis in Podophyllum, by Aug. F. Foerste, Botanical Gazette, Vol. VIII, No. 7, July, 1883, p. 259.

Notes on *Dedoublement* in specimen of Podophyllum at Dayton.

New species of North American Fungi, by J. B. Ellis and W. A. Kellerman in American Naturalist, Nov., 1883, pp. 1164–1166.

Fourteen species are enumerated and described of which ten were collected in Ohio, (the remaining in Kansas).

1884.

Report on weeds (by W. S. Devol) second report of the Ohio Agr. Experiment Station for 1883, Columbus, 1884, p. 187.

Notices number of weeds in the state, means of destruction and commonest ones in different sections of the state. A part of the same article is also reported under "Report of Committee on Botany" in the proceedings of Columbus Horticultural Society, Dec. 4, 1884.

Abnormal Trillium, by Jos. F. James. Botancial Gazette, Vol. IX, No. 7, July, 1884, p. 113.

Four-parted Trillium erectum, whorl of three leaves and small leaf on peduncle.

Contributions to the Flora of Cincinnati, by Jos. F. James, in the Journal of the Cincinnati Society of Natural History, July, 1884.

The article covers fourteen pages and gives the results of observations of the plants of the vicinity of Cincinnati, which have been accumulating the past two years. Besides critical notes on the species, new localities are given for many plants and a few, not before reported for that region, are given.

1885.

Descriptive notes of some of the newer and least known weeds of the State (W. R. Lazenby) in the Third Annual Report of the Ohio Agr. Experiment Station for 1884, Columbus, 1885, p. 164.

Twelve species are described from notes "from the answers received from the circulars and from observations made by the Station."

Abnormal Trillium, and Violet with Runners, by Jos. F. James. Bulletin of Torrey Botanical Club, Vol. X, No. 5, May, 1885, p. 57.

Two notes as to, (1) Trillium sessile with parts mostly in fives and (2) runners, twelve to eighteen inches long of Viola striata.

1886.

Report on Forestry (by W. R. Lazenby), in Fourth Annual Report of the Ohio Agr. Experiment Station for 1885, Columbus, 1886, pp. 242.

The report covers two pages (242–3) and contains, (1) a "list of the principal timber trees of Ohio," fifty-one species, both common and scientific names are used; (2) a tabulation of "comparative growth and hardiness of forest tree seedlings," sixteen species.

Report on Weeds (by W, S. Devol), in Fourth Annual Report of the Ohio Agr. Experiment Station for 1885, Columbus, 1886, p. 193.

This report covers fourteen pages and includes "weeds on different soils" (pp 193); "general remarks" (p. 194); "descriptive notes of five species" (pp.194–196); "prolificacy of weeds" (pp. 196–198, essentially the same also in the Journal of the Columbus Horticultural Society, Vol. III, No. 3, March, 1888, pp. 38–43); and a "List of the Plants of Ohio (229 species) which generally appear as weeds" (pp. 198–206).

The Flora of Ross County, Ohio, Compared with that of New England, by W. E. Safford. Bulletin of the Torrey Botanical Club, Vol XIII, No. 7, July, 1886.

Notices a large number of conspicuous plants, many of which do not reach New England.

Natural History of the Grape, by W. R. Lazenby, in Proceedings of the Columbus Horticultural Society, Columbus, Sept. 25, 1886, pp. 4.

A general account of the family and gives four species growing wild in Ohio; Vatis Librusca, V. âestivalis, V. riparia, and V. cordifolia.

Notes on some Introduced Plants chiefly in Summit county, Ohio, by E. W. Claypoole, in Bulletin of the Torrey Botanical Club, Vol. XIII, No. 10, Oct., 1886, p. 187.

A record of some introduced plants; ten species of which are well established and six represented by a single specimen of each.

1887.

Report on Weeds (by W. S. Devol) in the Fifth Annual Report of the Ohio Agr. Experiment Station for 1886, Columbus, 1887, p. 230.

Sixteen species are named which "have been discovered in the State since the publication of Dr. Beardslee's Catalogue of Plants of Ohio," (pp. 230) (The same list is printed in the Journal of the Columbus Horticultural Society, Vol. III, No. 1, Jan., 1888, p. 47). This list is followed by a "list of plants identified" (pp. 231–3).

Botanical Notes (by W. R. Lazenby) in the Fifth Annual Report of the Ohio Agr. Experiment Station for 1886, Columbus, 1887, pp. 304.

A few short notes are given (p. 304) followed by a list (pp. 305–7) of seventy-four species with their dates of blooming in the years 1882–7.

Notes on Sanguinaria Canadensis by Aug. F. Foerste, in the Bulletin of the Torrey Botanical Club, Vol. XIX, No. 4, April, 1887, p. 74.

An article two pages in length and one plate giving the morphology of the plant; locality, Dayton.

List of Algae, by H. L. Jones, in bulletin of the Scientific Laboratories of Dennison University, May, 1887, Vol. II, pp, 115–6.

A list of thirty-four species, mostly Desmids, found in the Licking Reservoir and the ponds about Granville, Ohio.

Botanical Notes (Liquidambar in Ohio) by Jos. F. James. Bulletin Torrey Botanical Club, Vol. XIV, No. 10, Oct. 4, 1887, p. 223.

Notes occurence of Liquidambar near Oxford and the vicinity of Cincinnati.

Plants in Bloom in September, October and November, (observed by Moses Craig and reported by W. S. Devol) Journal of the Columbus Horticultural Society, Vol. II, Nos. 10, 11, 12, Oct., Nov., Dec., 1887, pp. 166, 189, 207.

The lists number eighty-eight, fifty-eight and six species respectively.

Note on the color of Caulophyllum thalictroides, by K. B. Clay pole. Bulletin of the Torrey Botanical Club, Vol. XIV, No. 12, Dec. 3 1887, p. 258.

Notices the less dark color of this species in Ohio than in Canada.

1888.

Botanical Notes (by W. R. Lazenby) in Sixth Annual Report of the Ohio Agr. Experiment Station for 1887, Columbus, 1888, p. 286.

This article consists of "plants named" pp. 286–8. Date of blooming of plants for 1882–7, a list of 317 species (pp. 289–298).

List of Diatoms from Granville, Ohio, by J. L. Deming, in Bulletin of the Scientific Laboratories of Dennison University, April, 1888, Vol. III, pp. 114–5.

A list of twenty-four species preceded by a general account of Diatoms.

Arbor Day Number, Journal of the Columbus Horticultural Society, Vol. III, No. 5, May, 1888.

Devoted to an account of Arbor Day exercises at the Ohio State University to which is appended a list of "Native Trees of Ohio."

List of Algae from Granville, Ohio, by Chas. L. Payne, in Bulletin of Dennison University, Dec. 1888, Vol. IV, Part I, p. 132.

Sixteen species are enumerated as an additional list to that published in 1887 by H. L. Jones. One Spirogyra "appears to be undescribed."

1889.

Preliminary List of the Flowering and Fern Plants of Lorain Co., Ohio, compiled by Albert A. Wright, professor of Geology and Natural History in Oberlin College, Oberlin, Ohio, 1889.

A pamphlet of thirty pages, containing a map of Lorain Co., a preface (pp. 3–5), list of botanical books (p. 5, eight entries) and list of plants (pp. 7–30). The plants introduced from other countries are printed in italics. The list was "made principally by putting together the observations of the compiler and a few friends who have made recent collections in this county * * * also the collection of the late Dr. Jas. Dascomb * * * the species ascribed to this county by Dr. Kellogg in Dr. Newberry's catalogue and those reported by Dr. H. L. Howard * * * in Beardslee's yet unpublished catalogue * * * have all been noted." There are 887 species enumerated.

Report of the Committe on Botany, by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. IX, No. 2, June, 1889, p. 35.

Notices the number of plants in bloom in March and gives a list of sixteen species.

Report of the Committee on Botany, by Aug. D. Selby, Columbus Horticultural Society, Vol. IV, No. 4, Dec. 1889, p. 107.

Notices rarity or profusion of blossoms according to deficiency or abundance of moisture and occurance of new and rare plants to the county.

1890.

A Catalogue of the Uncultivated Flowering Plants growing on the Ohio State University grounds, by Moses Craig, in the Bulletin of the Ohio Agr. Experiment Station, Technical Series, Vol. I, No. 2, May, 1890, pp. 49–110.

The catalogue proper is preceded by an Introduction, Limits of the flora and its physical characters, Geology of the farm, Notes on the climate, Extent and beauty of our flora, Time of blooming of plants, maps, classification, statistics of the catalogue, etc., pp. 49–61. The number of species and varieties enumerated is 468. In nearly every case they are accompanied by full notes as to occurance, abundance, etc.

A preliminary List of the Plants of Franklin county, Ohio, prepared for the Columbus Horticultural Society by Aug. D. Selby and Moses Craig, M. S. Committee on Botany for 1890:

A pamphlet of nineteen pages, three of which (3–5) contain the Introduction, twelve (7–18) include the neatly printed list—the genera in black-faced type arranged alphabetically under the orders, and the species alphabetically arranged under the genera—and the last page (19) gives a summary of added and introduced plants. The list contains 1,002 plants, being an addition of 223 to Sullivant's Catalogue published fifty years before.

Mycologic Observations, I. (January 1890), by A. P. Morgan, Botanical Gazette, Vol. XV, No. 4, April, 1890, p. 34.

Notices many fungi to be seen in Winter, as Agaricus Sepridas, Tremellas, Schizophyllum, Menispora, Aithrosporum, Bactridium, Naematelia, Stereum, Dacrymyces.

Supplementary List to the Plants of Ohio preliminary to a complete catalogue of the flora of the State, by William R. Lazenby and W. C. Werner. Department of Botany and Horticulture, Ohio State University, Columbus, Ohio, 1890.

Native species are printed in heavy faced type, those introduced in small capitals. "The total number of plants, including both species and varieties, enumerated in this list, is one hundred twenty three. Of this number sixteen are cryptogams. Deducting these there are one hundred thirteen indigenous and sixty-four introduced Phaenogams."

Plants blooming in February and March, by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. V. No. 2, June, 1890, p. 24.

Gives date of blooming of twenty-four species.

The Snowy Trilluim (T. nivale, Riddell), By Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. V, No. 2, June, 1890, p. 36.

Gives a general description, its distribution and a full page plate.

Prickly Lettuce—An Introduced Weed, By Miss Freda Detmers, Journal of the Columbus Horticultural Society, Vol. V, No. 3, September, 1890, p. 53.

Gives a general description of the plant, illustrated by a plate showing inflorescence and leaves, natural size.

Wild Carrot (Daucus Carota, L.), by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. V. No. 3, September, 1890, p. 70.

Gives a general description and notices its distribution and means of eradication.

The Lakeside Daisy, by Clarence M. Weed, Journal of the Columbus Horticultural Society, Vol. V. No. 3, September, 1890, p. 72.

Describes and notices occurrences of Actinella acaulis in the limestone plains of the Sandusky Peninsula. (The plant found was Actinella scaposa, var. glabra, and not A. acaulis.)

Report of committee on botany, by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. V, No. 4, December, 1890, p. 85.

Mentions results of collecting during the year and the new finds at Sellsville, near Columbus.

1891.

Notes from Columbus, Ohio, by Aug. D. Selby, Botanical Gazette XVI, No. 5, May, 1891, p. 148.

Notes occurrence of Bidens connata with upwardly barbed awns and gives list of introduced plants on circus grounds of Sells' Brothers near Columbus, Ohio.

Our Native Oaks, by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. VI, No. 2, June, 1891, p. 41.

Gives a general account of the oaks and recommends for cultivation for ornamental purposes especially the Pin Oak, also; Yellow, Scarlet and Laurel Oaks.

The Fungous Diseases of Lettuce, by Miss Freda Detmers, Journal of the Columbus Horticultural Society, Vol. VI, No. 2, June, 1891, p. 47.

Notices and describes Septoria Lactucae, Septoria consimilis and Peronospora gangliformis.

Botany—May, (under Communications and Discussions), by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. VI, No. 2, June, 1891, p. 63.

Notices the collecting of several rare plants near Columbus.

Some Troublesome Weeds and the Ohio Statutes Relating to Weedy Plants, by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. VI, No. 3, September, 1891, p. 96.

Mentions characteristics of a weed and gives the six worst weeds for Franklin county (Wild Carrot, Canada Thistle, Wheat Thief, Moth Mullein, Toad Flax, Ribgrass, and Narrow Dock) and Ohio laws relating to Weeds.

Plants Introduced at Sellsville, near Columbus, Ohio, by W. R, Lazenby. Bulletin of the Torrey Botanical Club, Vol, XVIII, No. 10. Oct. 1891, p. 301.

Gives a list of eighteen plants occurring in the place used by Sells' Brothers as the winter quarters for their circus and menagerie, seven of which occur elsewhere in the state.

List of plants observed growing wild in the vicinity of Cincinnati. Ohio, by C. G. Lloyd, Cincinnati, Ohio, Oct. 1891.

A pamphlet of eight pages giving list of six hundred seventeen species of phenogams and vascular cryptogams.

Diseases of the Raspberry and Blackberry, by Miss Freda Detmers In Bulletin of the Ohio Agricultural Experiment Station Second Series, Vol. IV, No. 6, Oct. 1891, p. 124.

A general account of four parasitic fungi infesting the raspberry and blackberry, namely Gloeosporium venetum, Septoria Rubi, Caeoma nitens, and Blight of Raspberry.

Report of the Committee on Botany, by Aug. D. Selby, Journal of the Columbus Horticultural Society, Vol. VI, No. 4, December, 1891, p. 111.

Mentions activity in collecting plants last year and gives over fifty "Additions to Preliminary List of the plants of Franklin county, Ohio."

Plum Pockets (Exoascus Pruni, Fckl.), By Miss Freda Detmers. Journal of the Columbus Horticultural Society, Vol. VI, No. 4, December, 1891, p. 113.

Notices occurence of Exoascus Pruniin the upper portions of Prunus Americana and on the same both of Monilia fructigenum, Pass. and Phyllosticta prunicola, Sacc.

Apple Scab (Fusicladium dentriticum), by Miss Freda Detmers, in Bulletin of the Ohio Agricultural Experiment Station, Sec. Ser. Vol. IV, No. 9, Dec. 1891, p. 187.

An account covering three pages, including general remarks, external characters and effect on host, and "microscopical characters."

1892.

On the Occurrence of Certain Western Plants at Columbus, Ohio, by Aug. Selby. Proceedings of the Indiana Academy of Science, 1891, Terre Haute, 1892, p. 74.

Mentions the blending in central Ohio of eastern and western species of plants and notices presence of "distinctly western and southwestern plants, introduced by wholesale, as it were," giving twenty such species as found on Sells Brothers' circus grounds at Columbus.

Variations and Intermediate Forms of Certain Asters, by W. C. Werner. Journal of the Cincinnati Society of Natural History, Vol. IV. No. 1, April, 1892, p. 55.

The variations of the species noticed in northern and Central Ohio are Aster Shortii, A. undulatus; A. cordifolius; A. saggittifolius; A. Lindleyanus.

A Fungous Enemy of Plant Lice (*Empusa Aphidis*), by Miss Freda Detmers. Journal of the Columbus Horticultural Society, Vol. VII, No. 1, March, 1892, p. 121.

Notices occurrence of Empusa Aphidis in greenhouse on various species of plant lice, as Phorodon mahaleb, Aphis mali, Aphis on chrysanthemum.

Some Fungous Pests of Greenhouse Plants, by W. A. Kellerman. Journal of the Columbus Horticultural Society, Vol. VII, No. 1, March, 1892, p. 20.

Describes two fungous diseases, carnation rust, (Uromyces carophyllinus [Schrank] Schroet.) and "damping off;" specimens of the former exhibited now occurring in Ohio.

Catalogue of the Phanerogams and Ferns of Licking County, Ohio. by Herbert L. Jones, in Bulletin of the Scientific Laboratories of Denison University, Vol. VII, pp. 4–103, March, 1892.

On pages 4 to 11 inclusive are given the Introduction, Herbaria, Geology of Licking county, Altitude of different points, rainfall, temperature, etc., a list of the worst weeds, times of flowering, trees, locations of special botanical interest, forms of certain species, nomenclature and map. The list of species (pp. 11–101) is accompanied with notes as to localities and dates, etc. The total number of species and varieties enumerated is 945. On page 102 are given a summary of species under distribution as to soil and comparison with other Ohio floras; on p. 103, errata. A map of the county accompanies the catalogue.

On the Flora of Northern Ohio, by Edo Claassen, in American Journal of Pharmacy, March and April, 1892.

This article covers nine pages and describes the explorations of the author made on the Lake Erie shore and islands. Rarer plants, peculiar to many different localities, are named, and finally a more extended list (of several hundred species) of plants more widely distributed concludes the paper.

Two New Genera of Hyphomycetes, by A. P. Morgan. Botanical Gazette, XVII, No. 6, June 1892, p. 190.

Descriptions are given of Cylindroctadium scoparium, Morgan, and Synthetospora electa, Morgan.

Forest Trees of Ohio for the World's Columbian Exposition (By W. A. Kellerman). Bulletin No. 5, Ohio World's Fair Commission, Columbus, (1892); also (in part) in First Quarterly Report of the Executive Commissioner for Ohio.

Contains a list of eighty-eight species, giving both botanical and common names; also a list of twenty-three species doubtfully classed as trees, five doubtfully occurring in Ohio.

Reports of Standing Committees: Botany; May. By Aug. D. Selby. Journal of the Columbus Horticultural Society, Vol. VII, No. 2, July, 1892,, p. 67.

Notices plants near Central College, allied to Appalachian Flora.

Reports of Standing Committees: Vegetable Pathology; May. By W. A. Kellerman. Journal of the Columbus Horticultural Society, Vol. VII, No. 2, July, 1892, p. 70.

Notices abundance of peach curl, black knot, and bramble rust; mentions weeds as harboring some fungi which are destructive to crops, hence the necessity of destroying them.

Field Experiments with Wheat, by J. Freemont Hickman, in the Bulletin of the Ohio Agricultural Experiment Station, Sec. Ser, Vol. V, No. 5, Aug. 1892, p. 83.

Under the sub-head of Scab and Smut (p. 93) note is made of prevalence of scab, loose smut and stinking smut or "bunt" on wheat.

Botanical papers at the A. A. A. S.; note on Yellow Pitch Pine, by W. A. Kellerman, Botanical Gazette, XVII, No. 9, Sept., 1892, p. 280.

Notices occurrence of a new variety of Pinus rigida, P. rigida, var. lutea, Kellerman, in Fairfield county, Ohio.

A Preliminary List of the Rusts of Ohio, by Miss Freda Detmers, in the Bulletin of the Ohio Agricultural Experiment Station, Sec. Ser Vol. V, No. 7, Sept. 1892, p. 133.

In the list (pp. 133–140) of sixty-eight species are given the name of the rust, the name of the plant on which it is found, the locality in, and the time at which it has been collected, together with occasional notes.

Description of a New Phalloid, by A. P. Morgan, in the Journal of the Cincinnati Society of Natural History, Oct., 1892.

A new genus and species (Phallogaster saccatus Morgan) found in Hamilton county (Morgan) Licking county (C. J. Herrick) also in New York and Connecticut are described and illustrated by a lithographic plate.

The Wild Plants of Northeastern Ohio; Preliminary List of the Wild Plants of Ashtabula county, by Sara F. Goodrich. Western Reserve School Journal, Geneva, Ohio, Nov., 1892, and Jan., 1893.

A preface precedes the list; the latter gives the scientific and common names of the plants.

New Plants for the Flora of Ohio, by W. C. Werner. Read before the Ohio State Academy of Science, Dec. 29, 1892. *

Notes the occurrence of Fossombronia cristata, Thuya occidentalis (apparently mistaken by early Ohio collectors for Chamæcyparis thyoides), Monarda clinopodia, Oxalis recurva, Lobelia puberula, Centauria Jacea Cyperus sylvaticus, Eleocharis quadrangulata, Bignonia capreolata, and Opuntia Rafinesquii.

Ohio Erysipheæ, by Aug. D. Selby. Read before the Ohio State Academy of Science, Dec. 29, 1892. *

Includes a general account of the group and a list of Ohio species with hosts, stations, dates, and collectors, and notes on many of the species.

A Few Rare Ohio Plants, by Aug. D. Selby. Read before the Ohio State Academy of Science, Dec. 29, 1891. *

Notes the occurence of Erysimum asperum and Gonolobus obliquus at Columbus; and Silene rotundifolia at Ash Cave, Hocking county.

New and Rare Plants for the flora of Ohio, by W. A. Kellerman. Read before the Ohio State Academy of Science, Dec. 30, 1892. *

Notices occurrence of one specimen of Ilex opaca, apparently native in Lawrence county; the occurrence of one specimen of Lea's oak, at Brownsville, Licking county; and Polypodium incanum, at Mineral Springs, Adams county; and an unsuccessful search for Magnolia tripetala, in Lawrence county.

---

* Published in this Bulletin.

Corrections and Additions to Moses Craig's Catalogue of the uncultivated flowering plants growing on the Ohio State University grounds, by W. A. Kellerman and Wm. C. Werner. Read before the Ohio State Academy of Science, Dec. 30, 1892. *

Gives a large number of corrected identifications and many additional species for the area covered.

Notes on the Distribution of Some Rare Plants in Ohio, by Wm. C. Werner. Read before the Ohio State Academy of Science, Dec. 30, 1892.*

The following are some of the plants: Sullivantia Ohionis, Iris cristata, Sabbatia angularis, Draba verna, Juncus Canadensis—with known extended range indicated.

The Uredineæ of Ohio, by Miss Freda Detmers. Read before the Ohio State Academy of Science, Dec, 30, 1892. *

Gives a general account of the life history of the species of the group and an annotated list of the unreported Ohio species.

The Lichens of Ohio, by E. E. Bogue. Read before the Ohio State Academy of Sciences, Dec. 30, 1892.

1893.

Additions to the Preliminary List of the Flowering and Fern Plants of Lorain County, Ohio, compiled by Albert A. Wright, Oberlin, Ohio, 1893. Laboratory Bulletin, No. 1, Supplement.

A pamphlet of eleven pages, giving a list of 106 additions, all the species being "authenticated by specimens now in the college herbarium."

The Myxomycetes of the Ohio Valley, Ohio, by A. P. Morgan. First paper (read Jan. 3, 1893), Journal of the Cincinnati Society of Natural History, Jan., 1893.

Gives a general description of the group, followed by descriptions of the species. Twenty-four species (five of them new) belonging to seven genera are described, accompanied by a plate of twelve figures.

ARTICLE XVI.—EXPERIMENTS IN GERMINATION OF TREATED SEED.

BY W. A. KELLERMAN, OHIO STATE UNIVERSITY.

The treatment of seed wheat and seed oats to prevent smut is now more generally practiced than heretofore. Well known and efficient fungicides are solutions of copper sulphate, potassium sulphide (Liver of Sulphur), and water raised to a temperature of 132—140° F.

---

* Published in this number of the Bulletin.

In testing and using the latter the writer and his assistant in the Kansas Experiment Station noticed that the treated seed invariably germinated more quickly than similar but untreated seed. (II. An. Rep. Kans. Exp. Sta.) The yield from the treated seed was also much greater—greater too than would be accounted for by the fact of replacing the usually smutted portion with sound grain.

The more rapid and better germination of treated seed was also noticed by Prilleaux, by Jensen, and later by J. C. Arthur. It was also noticed by the latter (See Bull. No. 35, Ind. Exp. Sta.) that not only at the time of treatment, but also after an interval of time had elapsed after the treatment of the seed with water at 132—135° F. the more rapid germination of the seed was yet noticeable.

Subsequently Dr. Arthur's germination experiments showed that this quicker germination of the treated seed was less marked the longer the interval after the treatment. The experiments detailed in tabular form below were instituted with a view of further testing this point.

It might be stated here that an explanation has lately been offered by Dr. Arthur for the more rapid germination of the seed treated with hot water. He claims that an enzyme or ferment is developed by heating the seed in water of a temperature of about 90° F., and this he thinks accounts for the more rapid germination.

The following tests were begun in July 1891 and repeated at subsequent intervals of $5\frac{1}{3}$, $13\frac{1}{4}$, and $17\frac{3}{4}$ months. Corn, oats and wheat were used.

The number of grains of each kind in each test varied from one hundred to five hundred seeds. The several lots of seed were treated with the following fungicides: (1) Water at 132° F., immersion 15 minutes; (2) Potassium Sulphide (Liver of Sulphur) $\frac{1}{2}$% solution, immersion eight hours, and (3) a similar solution, immersion twenty-four hours. Rain water at ordinary summer temperature was used for the solutions. Untreated seed was also used in case of each test, for comparison.

Wooden trays were used partially filled with sand and placed in the greenhouse. The seeds were placed on the surface of the moistened sand and at once dampened with an atomizer. They were protected from too rapid evaporation by a plate of glass. At the end of each period of twenty-four hours the atomizer was again used.

The following tables show the result:

TABLE SHOWING GERMINATION OF CORN AT INTERVALS AFTER TREATMENT.

When tested	Mode of treatment of seed.	Percentage germination.			
		1st day.	2d day.	3d day.	8th day.
At time of treatment..........	*UNTREATED*..........................	*0*	*12*	*35*	*100*
"	Water 132° F.; immersion 15 min.....	0	23	53	100
"	Potas. Sulphide ½ % sol. 8 hours.......	0	36	70	100
"	Potas. Sulphide ½ % sol. 24 hours......	42	85	97	100
5½ months after treatment..	*UNTREATED*..........................	*0*	*1*	*29*	*99*
"	Water 132° F.; immersion 15 min....	0	5	37	99
"	Potas. Sulphide ½ % sol. 8 hours.......	0	0	14	97
"	Potas. Sulphibe ½ % sol. 24 hours......	0	0	1	75
13¼ months after treatment..	*UNTREATED*..........................	*0*	*70*	*97*	*97*
"	Water 132° F.; immersion 15 min....	0	38	98	99
"	Potas. Sulphide ½ % sol. 8 hours......	0	33	92	97
"	Potas. Sulphide ½ % sol. 24 hours.....	0	2	15	66
17½ months after treatment.	*UNTREATED*..........................	*0*	*0*	*13*	*97*
"	Water 132° F.; immersion 15 min.....	0	0	27½	100
"	Potas. Sulphide ½ % sol. 8 hours.......	.....	.....	.....	.....
"	Potas. Sulphide ½ % sol. 24 hours......	0	0	0	35

It is seen from the above table that the quickest germination, when tested at time of, or rather immediately after treatment, was that of the seed soaked in potassic sulphide twenty-four hours. But the time of putting the seed in the solution should be taken as the starting point in this case: that is, the "1st day" in the table should be counted as the second and the "2d day" as the third; then the comparison with the other percentages can be properly made.

The first test showed most favorably for the sulphide treatment twenty-four hours. The sulphide treatment for eight hours stood next, and the hot water treatment third. The untreated seed was the slowest to germinate.

In the second, third and fourth tests the most favorable results are shown by the seed of the hot-water treatment. Those with the potassic sulphide treatments fall below the untreated seed.

The seed treated twenty-four hours with the potassic sulphide, though germinating well at the time of treatment, was evidently injured for late germinations. The deterioration continued cumulatively to the last test where the result is very marked — no germination at all the third day and only 35 % at the eighth day.

TABLE SHOWING GERMINATION OF OATS AT INTERVALS AFTER TREATMENT.

When tested.	Mode of treatment of seed.	Percentage Germination.			
		1st day.	2d day.	3d day.	8th day.
At time of treatment..........	*UNTREATED*............................	*0*	*32*	*81*	*99*
“	Water 132° F.; immersion 15 min....	0	59	76	97
“	Potas. Sulphide ½% sol. 8 hours........	0	59	81	91
“	Potas. Sulphide ½ % sol. 24 hours.....	10	58	74	75
5½ months after treatment...	*UNTREATED*............................	*0*	*51*	*87*	*99*
“	Water 132° F.; immersion 15 min....	1	68	93	99
“	Potas. Sulphide ½ % sol. 8 hours.......	0	78	93	98
“	Potas. Sulphide ½ % sol. 24 hours.	0	72	83	87
13½ months after treatment.	*UNTREATED*............................	*1*	*60*	*79*	*85*
“	Water 132° F.; immersion 15 min....	0	56	77	85
“	Potas. Sulphide ½ % sol. 8 hours.......	0	37	52	70
“	Potas. Sulphide ½ % sol. 24 hours......	0	25	33	56
17¾ months after treatment.	*UNTREATED*............................	*0*	*6*	*27*	*35*
“	Water 132° F.; immersion 15 min....	0	1½	27½	53
“	Potas. Sulphide ½ % sol. 8 hours.......	0	0½	10	33
“	Potas. Sulphide ½ % sol. 24 hours......	0	1	10	29

The test with oats, like that with corn, shows a quicker germination immediately after treatment, for the twenty-four hour potassium sulphide treatment. This of course would not be unexpected. The showing, however, is not so favorable if we count as the beginning of germination the time of immersion in the solution, *i. e.*, count the “1st day” in the table as the second day, and the “second day” as the third.

The tests at intervals show oftenest the most favorable results for the hot-water treatment.

They also show that the twenty-four hour immersion in potassic sulphide solution was detrimental to the germination.

The germination at the end of the second interval was not so good as before and at the end of the last interval it shows marked deterioration—the greatest with the potassium sulphide treatment.

TABLE SHOWING GERMINATION OF WHEAT AT INTERVALS AFTER TREATMENT.

When tested.	Mode of treatment of seed.	Percentage Germination.			
		1st day.	2d day.	2d day.	8th day.
$5\frac{1}{2}$ months after treatment..	*UNTREATED*..............................	*34*	*93*	*98*	*99*
"	Water 132° F.; immersion 15 min....	10	59	79	97
"	Potas. Sulphide $\frac{1}{2}$ % sol. 8 hours......	36	86	91	93
"	Potas. Sulphide $\frac{1}{2}$ % sol. 24 hours......	30	89	93	95
$13\frac{1}{4}$ months after treatment.	*UNTREATED*............................	*45*	*83*	*86*	*87*
"	Water 132° F.; immersion 15 min....	5	67	78	89
"	Potas. Sulphide $\frac{1}{2}$ % sol. 8 hours......	49	72	76	76
"	Potas. Sulphide $\frac{1}{2}$ % sol. 24 hours.....	32	60	63	65
$17\frac{3}{4}$ months after treatment.	*UNTREATED*............................	*0*	*41*	*61*	*69*
"	Water 132° F.; immersion 15 min....	0	$23\frac{1}{2}$	47	57
"	Potas. Sulphide $\frac{1}{2}$ % sol. 8 hours.......	0	$36\frac{1}{2}$	51	54
"	Potas. Sulphide $\frac{1}{2}$ % sol. 24 hours.....	0	36	50	58

The above table of results is not so satisfactory as the preceding, since unaccountable irregularities occur throughout.

The most favorable results are those of the potassium sulphide treatment except those after the longer intervals, when a decline in germinating power is noticeable.

GENERAL CONCLUSIONS.

The treatment of seed with either of the two smut fungicides—Hot-water (132° F., 15 minutes,) and Potassium Sulphide ($\frac{1}{2}$ % solution) — is to be recommended for hastening the germination of the smut spores and to induce the plant to pass as quickly as possible the period of greatest vulnerability to smut infection, namely, the earliest stage of the seedling when it is extremely delicate.

The treated seed generally shows a better germination than untreated seed. The germination at the end of a few months is scarcely as favorable, and after a long interval it is plainly inferior.

Whether the explanation of better germination of treated seed is to be sought for in some, possible change in the testa or seed coats, or portions exterior to the embryo, perhaps rendering them better moisture-absorbing agents, is not known. The explanation referred to above, namely, the development of an enzyme by gentle heat, though it may account for the better germination in case of the seed treated with hot water, evidently would be no explanation for the improved germination of the seed treated with potassium sulphide; since in the latter case no heat was applied and water of ordinary summer temperature of rain water stored in a cistern was used.

ARTICLE XVII—ANALYTICAL SYNOPSIS OF THE GROUPS OF FUNGI.

By W. A. Kellerman and Aug. D. Selby.

In Saccardo's Sylloge Fungorum there is given a comprehensive system of classification which, whatever may be said of its defects, is better than no system, and its use will doubtless become general. It seems therefore appropriate that an introductory key to the several groups should be prepared for the use of beginners.

An artificial key according to the dichotomal method—being simple and easily mastered by beginners and amateurs—may serve for first introduction, though upon slight acquaintance with the principal groups the analytical synopsis will be preferred.

We have therefore prepared the two keys—the first as simple as possible (though we hope reasonable accuracy has not been sacrificed)—the second being essentially a translation of Saccardo's Conspectus systematicus generalis (in Sylloge Fungorum, Vol. VIII, p. XIII). The volume and page where each family may be found in the Sylloge are also given.

It is hoped that this essay may be of some service in furthering the rapidly increasing interest in mycological studies—nowhere more marked than in connection with the Experiment Stations, particularly in reference to those fungi of economic interest.

ARTIFCIAL KEY.

1. Plants usually large (the so-called "higher fungi") at least the fruiting body large, the vegetative stage less conspicuous or not evident; asci never present (2).

1. Plants usually small or microscopic; asci present or absent (8).

    2. Hymenium, i. e. spore-bearing layer, external (*Hymenomycetes*) (3.)

    2. Hymenium, i. e. spore-bearing layer, internal (*Gasteromycetes*.) (6).

3. Hymenium in the form of lamellæ, tubes, pores or spines (4).

3. Hymenium not as above, smooth (5).

    4. Hymenium in the form of lamellæ....................I. Agaricaceæ

    4. Hymenium in the form of tubes or pores..........II. Polyporaceæ

    4. Hymenium in the form of soft spines...............III. Hydnaceæ

5. Fungi more or less coriaceous........... ....IV. Thelephoraceæ

5. Fungi more or less fleshy....................................V. Clavariaceæ

5. Fungi gelatinous..VI. Tremellaceæ

6. Fungi terrestrial, i. e. not underground (7).
6. Fungi subterranean ....X. Hymenogastraceæ
7. Bursting from a volva (sac), deliquescent ....VII. Phallaceæ
7. Somewhat cup-shaped, coriaceous ....VIII. Nidulariaceæ
7. Sub-membranaceous, pulverulent within.............IX. Lycoperdaceæ
8. Asci absent (9).
8. Asci present (*Ascomycetes*) (26).
9. Vegetative stage of free protoplasm, i. e. plasmodium present (*Myxomycetes*) (10).
9. Vegetative stage not as above, no plasmodium (11).
10. Spore receptacles (*peridia*) none; zoospores present............... ....XLIX. Monadinaceæ
10. Peridia slightly developed, capitate, clavate; no zoospores......... .... L. Sorophoraceæ
10. Peridia perfect; zoospores present.............LI. Myxomycetaceæ
11. Well developed perithecia [*pycnidia*] present (*Sphæropsideæ*) (12).
11. Perithecia absent (13).
12. Perithecia ostiolate or astomous, black........LII. Sphærioidaceæ
12. Perithecia ostiolate, bright colored.............LIII. Nectrioidaceæ
12. Perithecia subdimidiate, black................LIV. Leptostromaceæ
12. Perithecia scutellate, patelliform or excipuliform..................... ....LV. Excipulaceæ
13. Mycelium none or not distinct (14).
13. Mycelium distinct or present (17).
14. Zoospores absent (15).
14. Zoospores present (16).
15. Multiplication gemmiparous and ascogenous................................ .... XLVII. Saccharomycetaceæ
15. Multiplication mostly by fission, no asci present......................... ....XLVIII. Schizomycetaceæ
16 Zoospores fully formed, distinctly ciliate......XVII. Chytridiaceæ
16. Zoospores indistinctly formed, scarcely ciliate...................... ....XVIII. Protomycetaceæ
17. Zoospores or zygospores present (18).
17. Zoospores and zygospores absent (22).
18. Mycelium distinct (19).
18. Mycelium obsolete (21).
19. Phytoparasitic, zygospores immersed, conidia superficial................. ....XIII. Peronosporaceæ
19. Zoo-parasitic, aerophilous, mostly zygosporiferous....................... ....XIV. Entomophthoraceæ
19. Saprogenous, zoosporiferous or zygosporiferous (20).
20. Hydrophilous, zoosporiferous...................XV. Saprolegniaceæ
20. Aerophilous, zygosporiferous.......................XVI. Mucoraceæ
21. Perfectly formed zoospores, evidently ciliate.......XVII. Chytridiaceæ

21. Zoospores indistinct, not plainly ciliate.........XVIII. Protomycetacæ

22. Imperfect fungi, i. e. complete life-history not known, conidiiferous (23).

22. Life history known (smuts and rusts), not bearing conidia (25).

23. Fungi innate in the matrix............................LVI. Melanconiaceæ

23. Fungi sub-superficial (24).

24. Pallid or bright-colored, lax, collapsing.......LVII. Mucedinaceæ

24. Fuscous or blackish, lax, rigid........ ....LVIII. Dematiaceæ

24. Pallid or fuscous, united into a stipe................LIX. Stilbaceæ

24. Pallid or fuscous, united into a wart-like acervulus.................. ... .LX. Tuberculariaceæ

25. Not pulverulent, spores pedicelled, fungi often polymorphic............ .... XI. Uredinaceæ

25. Black powdery when mature (*smuts*), spores not pedicelled.......... .... XII. Ustilaginaceæ

26. Fungi terrestrial, i. e. not underground (27).

26. Fungi subterranean (35).

27. On animals or animal matter, spore-receptacle subglobose................ ....XLI. Onygenaceæ

27. Entomogenous, spore-receptacle very small, stipitate...................... ....XLII. Laboulbeniaceæ

27. Not as above; growing on plants or vegetable matter (28).

28. Spore-receptacle monascous, immersed in a tuberculiform stroma...XL. Phymatosphæriaceæ

28. Spore-receptacle polyascous, closed or ostiolate (*Pyrenomycetes*) (29).

28. Spore-receptacle polyascous, open disc-like or cup-like (*Discomycetes*) (38).

29. Perithecia dimidiate (30).

29. Perithecia not as above (31).

30. Perithecia perforate or astomous............XXIV. Microthyriaceæ

30. Perithecia rimosely dehiscent........... XXVII. Hemihysteriaceæ

31. Perithecia perfect (32).

31. Perithecia (*loculi*) immersed in, not separable from, the stroma......... ....XXIII. Dothideadceæ

32. Perithecia ostiolate (33).

32. Perithecia astomous...............................XIX. Perisporiaceæ

33. Perithecia dehiscent by a longitudinal fissure.......................... .... XXVI. Hysteriaceæ

33. Perithecia not as above (34).

34. Ostiolum punctiform, perithecia black.............XX. Sphæriaceæ

34. Ostiolum punctiform, perithecia bright colored.................... .... XXII. Hypocreaceæ

34. Ostiolum infundibuliform, perethecia black...XXI. Coryneliaceæ

34. Ostiolum compressed...........................XXV. Lophostomaceæ

35. Sporidia at length dissolving into powder (36).
35. Sporidia not dissolving into powder (37).
  36. Capillitium present..........................XLIII. Elaphomycetaceæ
  36. Capillitium absent.............................. XLIV. Cenococcaceæ
37. Gleba venose, lacunose or cavernose....................XLV. Tuberaceæ
37, Gléba evenose, solid............. ....XLVI. Endogonaceæ
  38. Ascomata (spore-receptacle) with no true excipulum, asci naked ....XXXVIII. Gymnoascaceæ
  38. Ascomata acrogenous on branching stipes...XXXVII. Cordieritaceæ
  38. Not as above (39).
39. Ascomata immersed (40).
39. Ascomata superficial (41).
  40. Ascomata bright colored............. ....XXXIV. Stictaceæ
  40. Ascomata black....................................XXXV. Phacidiaceæ
41. Fungi biogenous, ascomata globose or ovoid......XXVIII. Cyttariaceæ
41. Not as above (42).
  42. Ascomata turbinate, pyriform or globose, very small stipitate, fibrose or subcorneous.................... ....XXXIX, Caliciaceæ
  42. Ascomata clavate, mitrate, capitate and stipitate, carnose or ceraceous .... XXIX. Helvellaceæ
  42. Ascomata turbinate or cupulate, gelatinous...XXXIII. Bulgariaceæ
  42. Not turbinate nor gelatinous, or not as above (43).
43. Ascomata carnose or ceraceous (44).
43. Ascomata coriaceous or corneous (45).
  44. Asci not erumpent; fungi rarely fimicolous......XXX. Pezizaceæ
  44. Asci erumpent; fungi mostly fimicolous.....XXXI. Ascobolaceæ
45. Ascomata subsessile or stipitate, often furfuraceous externally...XXXII. Dermateaccæ
45. Ascomata sessile, minute, not furfuraceous......XXXVI. Patellariaceæ

SYNOPSIS.

Series I. Fungi exclusive of the "form genera."

A. PLASMODIUM ABSENT.

B. MYCELIUM DISTINCT, OR RARELY OBSOLETE.

C. ASCI ABSENT.

D. RECEPTACLE (FRUITING BODY) DISTINCT.

E. HYMENIUM EXTERNAL (HYMENOMYCETES).

I. Agaricaceæ (S. Vol. V, p. 3); Hymenium lamellate.
II. Polyporaceæ (S. VI. 1); Hymenium tubulose or porose.
III. Hydnaceæ (S. VI. 429); Hymenium aculeate.
IV. Thelephoraceæ (S. VI. 513); Hymenium smooth; fungi subcoriaceous.

V. Clavariaceæ (S. VI. 690); Hymenium smooth; fungi subcarnose.

VI. Tremellaceæ (S. VI. 760); Hymenium smooth; fungi gelatinous.

E. HYMENIUM INTERNAL (GASTEROMYCETES).

VII. Phallaceæ (S. VII. 1); Fungi epigeous, with a volva, deliquescent.

VIII. Nidulariaceæ (S. VII. 28); Fungi epigeous, coriaceous, subcyathiform.

IX. Lycoperdaceæ (S. VII. 48); Fungi epigeous, submembranaceous, utriculate, pulverulent within.

X. Hymenogastraceæ (S. VII. 154); Fungi hypogeous, subcarnose, never pulverulent.

D. RECEPTACLE (FRUITING BODY) WANTING OR OBSOLETE.

F. Mycelium distinct.

G. Zygospores and zoospores wanting.

XI. Uredinaceæ (S. VII. 528); Parasitic, scarcely pulverulent, spores stipitate; fungi often polymorphic, i. e. two or more stages in the life cycle.

XII. Ustilaginaceæ (S. VII. 449); Parasitic, mostly pulverulent, conglobulate, spores subsessile, not polymorphic, rarely conidiiferous.

G. Zoospores or zygospores present.

H. Phytoparasitic.

XIII. Peronosporaceæ (S. VII. 233); zygospores immersed in the matrix conidia superficial.

H. Zooparasitic.

XIV. Entomophthoraceæ (S. VII. 280); Aerophilous, zygosporiferous (rarely azygosporiferous).

H. Saprogenous.

XV. Saprolegniaceæ (S. VII. 264); Hydrophilous, zoosporiferous.

XVI. Mucoraceæ (S. VII. 181); Aerophilous, zygosporiferous.

F. Mycelium obsolete.

XVII. Chytridiaceæ (S. VII. 319); Zoospores formed by division of the protoplasm, distinctly ciliate.

XVIII. Protomycetaceæ (S. VII. 286); Zoospores indistinct, mycelium scarcely manifest.

C. ASCI PRESENT.

K. Fungi epigeous.

L. Spore-receptacles (perithecia) closed or ostiolate, polyascous (Pyrenomycetes).

XIX. Perisporiaceæ (S. I. 1); Perithecia astomous, usually black.

XX. Sphaeriaceæ (S. I. 88); Perithecia punctiform-ostiolate, black.

XXI. Coryneliaceæ (S. IX. 1073); Perithecia infundibuliform-ostiolate, black.

XXII. Hypocreaceæ (S. II. 447); Perithecia punctiform-ostiolate, bright colored.

XXIII. Dothideaceæ (S. II. 588); Perithecia (loculi) immersed in and scarcely separable from the stroma.

XXIV. Microthyriaceæ (S. II. 650); Perithecia dimidiate, scutellate, pierced or astomous.

XXV. Lophiostomaceæ (S. II. 672); Perithecia compressed ostiolate.

XXVI. Hysteriaceæ (S. II. 721); Perithecia opening by a longitudinal fissure.

XXVII. Hemihysteriaceæ (S. IX. 1094); Perithecia dimidiate, rimosely dehiscent.

L. Spore-receptacles (ascomata) mostly open-discoid, polyascous (Discomycetes).

XXVIII. Cyttariaceæ (S. VIII. 4); Ascomata subglobose peripherally pluriloculate, superficial.

XXIX. Helvellaceæ (S. VIII. 7); Ascomata clavate, mitrate, capitate, stipitate, superficial.

XXX. Pezizaceæ (S. VIII. 53); Ascomata cupulate or flat, carnose or ceraceous; asci not erumpent.

XXXI. Ascobolaceæ (S. VIII. 512); Ascomata cupulate or flat, carnose, superficial; asci erumpent.

XXXII. Dermateaceæ (S. VIII. 545); Ascomata cupulate or flat, suberose-coriaceous, erumpent, superficial.

XXXIII. Bulgariaceæ (S. VIII. 607); Ascomata turbinate or cupulate, gelatinous, superficial.

XXXIV. Stictaceæ (S. VIII. 647); Ascomata immersed, bright-colored, ceraceous.

XXXV. Phacidiaceæ (S. VIII. 705); Ascomata immersed, black, ceraceous.

XXXVI. Patellariaceæ (S. VIII. 768); Ascomata superficial, black, subcorneous.

XXXVII. Cordieritaceæ (S. VIII. 810); Ascomata acrogenous on branches.

XXXVIII. Gymnoascaceæ (S. VIII. 811); Ascomata spurious; asci naked, superficial.

XXXIX. Caliciaceæ (S. VIII. 825); Ascomata turbinate, often black, fibro-corneous.

L. Spore-receptacles (locelli) closed, monascous.

XL. Phymatosphæriaceæ (S. VIII. 843); Locelli immersed in a very small tuberculiform stroma.

L. Spore-receptacles subglobose; fungi epizoic.

XLI. Onygenaceæ (S. VIII. 861); Ascomata membranaceous, fragile, often stipitate.

L. Spore-receptacles (perithecia ?) conical, very small, fungi parasitic (entomogenous).

XLII. Laboulbeniaceæ (S. VIII. 909); Perithecia conical, ovoid or cylindrical.

K. Fungi hypogeous.

XLIII. Elaphomycetaceæ (S. VIII. 863); Gleba at length pulverulent, capillitium present.

XLIV. Cenococcaceæ (S. VIII. 871); Gleba at length pulverulent, capillitium absent.

XLV. Tuberaceæ (S. VIII. 872); Gleba venose or lacunose, never pulverulent.

XLVI. Endogonaceæ (S. VIII. 905); Gleba solid, never pulverulent.

B. MYCELIUM NONE OR NOT DISTINCT.

XLVII. Saccharomycetaceæ (S. VIII, 916); Multiplication gemmiparous and ascogenous; fungi zymogenous.

XLVIII. Schizomycetaceæ (S. VIII. 923); Multiplication scissiparous and endogenous; fungi patho-chromo-zymogenous.

A. Plasmodium present [the Vegetatve Stage].

XLIX. Monadinaceæ (S. VII. 453) Spore-receptacles (peridia) wanting; zoospores present.

L. Sorophoraceæ (S. VII. 450); Spore-receptacles (peridia) not perfect, capitate, clavate, small, zoospores none.

LI. Myxomycetaceœ (S. VII. 323); Spore-receptacles (peridia) perfect; zoospores present.

Series II. Imperfect Fungi (Stages only in the cycle of development.)

M. Perithecium (pycnidium) present [Sphaeropsideae]

LII. Sphærioidaceæ (S. III. 1); Perithecia perforate or astomous, black.

LIII. Nectrioidaceæ (S. III. 613); Perithecia perforate, bright colored.

LIV. Leptostromaceæ (S. III. 625); Perithecia subdimidiate, ostiolate, rimosely dehiscent or astomous, black.

LV. Excipulaceæ (S. III. 664); Perithecia scutellate, patellate or excipuliform.

M. Perithecium (pycnidium) absent; fungi innate in the matrix.

LVI. Melanconiaceæ (S. III. 696).

M. Perithecium (pycnidium) none; fungi sub-superficial (Hyphomycetes).

LVII. Mucedinaceæ (S. IV. 2); Pallid or bright colored, lax, collapsing.
LVIII. Dematiaceæ (S. IV. 235); Fuscous or black, lax but rather rigid.
LIX. Stilbaceæ (S. IV. 563); Pallid or fuscous, in a stipe-like fascicle.
LX. Tuberculaceæ (S. IV. 635); Pallid or fuscous, in a verruciform acervulus (*sporodochium*).

ARTICLE XVIII.—THE OHIO ERYSIPHEÆ.

By Aug. D. Selby.

It has been the aim in the following pages to give briefly the characters of the Erysipheæ, and to present a list of those species which have so far been found in the state. In the characterization of the family only so much is noted as may serve to distinguish it from others, and form the basis for intelligent effort in the application of remedies.

The material upon which the list is based was obtained from several sources; but as yet no systematic collection of the fungi of the whole state has ever been undertaken. Prof. W. A. Kellerman has kindly given access to material of all the Ohio species in his herbarium, and to a large number of specimens collected by him in 1892. Miss Freda Detmers likewise permitted me to use a large number from her herbarium. These included collections by Miss Detmers, Dr. C. M. Weed and by others connected with the Experiment Station, made chiefly in 1888, 1889 and 1890. Collections made the past season by Mr. W. C. Werner, Mr. E. E. Bogue and the writer, were also examined. Specimens were contributed by Mr. H. L. Jones and Miss Sara F. Goodrich. Obligations to the above named persons and to others, whose names appear in connection with the enumeration of specimens, are gratefully acknowledged.

The account given of the species is very brief where specific characters are mentioned at all. One species of Uncinula appears to be new to science, and is so described. The student is referred to the few books named below. These are the most available and useful:—North American Pyrenomycetes, by J. B. Ellis and B. M. Everhart, 1892—Erysipheæ, by Prof. T. J. Burrill; Parasitic Fungi of Illinois, Part II, Erysipheæ, by T. J. Burrill and F. S. Earle [Bulletin Illinois State Laboratory of Natural History, Vol. II, Article VI]; the Erysipheæ in Winter's "Die Pilze," Band I, II Abth., and in Saccardo's Sylloge Fungorum Vol. I.

Illustrations of the genera are given in Burrill and Earle's Erysipheæ of Illinois, and in Winter. These are helpful to the beginner.

In the limitation of species and in nomenclature Prof. Burrill's last account of the group has been followed. The synonymy may be found in his works.

For the study of amateurs, the Erysipheæ possess some marked advantages. They are everywhere present in greater or less abundance, and, unlike so many of the fungi, have both the conidial and complete stages upon the same host. For ordinary purposes of determination the characters are sufficiently evident and do not require high powers of magnification. The variation in form and structure is yet enough to attract the amateur microscopist who seeks something worthy of his effort. It may also be added that the latest and best descriptions of American species are those of Prof. Burrill, in the works cited.

Many imperfections and omissions must exist in this first enumeration of the Ohio mildews. Contributions of specimens are solicited, that a more complete account may be possible.

ERYSIPHEÆ, Léveillé.

The Erysipheæ, powdery mildews or leaf mildews, as they are sometimes called, are easily recognized by the white web-like or dusty coating they form upon a large number of common plants. Being most frequent upon the leaves of the host, they are therefore spoken of as "leaf mildews," although found upon stem and fruit likewise. These mildews appear to develop in late summer or fall, when the white covering upon the parts affected cannot fail to be observed.

In many cases the growth of the fungus begins earlier in the season, but attention is rarely called to it until a large part of the leaf, stem or fruit becomes involved.

The growth in question consists of web-like branching threads, *hyphæ*, attached at intervals, by means of special branches called haustoria, to the surface of the part or leaf over which it spreads. This ramification of threads mutually crossing and recrossing, and all the time growing very close to the surface of the leaf, is the *mycelium* or vegetative portion of the fungus. The mycelium is usually abundant in this group, but sometimes sparse; the hyphæ composing it are very numerous, slender, branched, septate, white or colorless. The *haustoria* occur at intervals, and penetrate only the epidermal cells of the host, serving for attachment and probably for nourishment.

As the development of the mycelium advances, erect branches are formed, similar to the others but destined for reproduction. At the tips of these upright branches or fertile hyphæ are found the non-sexual spores or *conidia*, placed one above another like the links of a chain. The presence of an immense number of these conidia gives to the fungus-covered surface its dust-like appearance. They are single-celled oval bodies, sometimes forming series of several spores, and are very easily detached. Their office is to propagate the fungus during the period favorable to its growth, but they are not able to withstand the severities of winter. Being light, the conidia are readily transported by the wind.

In later summer and fall a number of small, dark or black spherical bodies are seen scattered over the mildewed leaf. These are the *perithecia* or fruiting bodies; within each matured perithecium one or more sacs or *asci* occur. Each ascus contains from two to eight *spores*, known as sexual spores, or asco-spores; they are here called *spores*. It is by means of these sexual spores that the parasite can survive the winter and the death of its host. They are analogous to the seeds of higher plants, and will grow after a longer or shorter period of rest.

The formation of the perithecium and the sexual pores contained in it, has been carefully studied by De Bary. For a full statement the reader is referred to his "Morphology and Biology of the Fungi, Mycetoza and

Bacteria," pp. 201–3, or the same author's Beiträge zu Morphologie and Physiologie der Pilze, III. Summarized, the process is as follows:—At the point of contact of two crossing hyphæ, each sends out a sort of special branch. The one from the lower thread gives rise to the *carpogonium*, homologous with the pistil of flowering plants. The other produces the *antheridium*, homologous with the stamens (anthers) of the flower. The former is fertilized by the latter, usually in later summer; the carpogonium then develops into the perethecium. At first colorless, this soon becomes yellowish, then finally dark or black. The perithecia are commonly globular in form, and are visible without a magnifying glass.

The wall of the perithecium varies in texture. Its cellular structure is evident from the reticulations upon its surface. There are no openings in the wall; the asci and spores escape only by the rupture or decay of the wall itself.

The *appendages*, as they are called, are slender, hair-like, outgrowths from the wall of the perithecium. These assume various forms, characteristic of the different genera, and may be similar to the mycelium, as in *Sphærotheca* and *Erysiphe*; dissimilar and coiled at the end, as in *Uncinula* (see Fig. 5, Pl. III); acicular, with a swollen base, as in *Phyllactinia*, or repeatedly two-forked, as in *Podosphæra* and *Microsphæra*. The appendages are characteristic in the different genera, and even in the different species of the same genus; notably so in *M.crosphæra*.

The asci are delicate, colorless sacs, containing spores. The spores are quite uniform in shape, usually elliptical in outline, though varying in size and number. Indeed, the number of asci in each perithecium and the number of spores in each ascus constitute diagnostic characters of very great value. Besides, the form of the haustoria is extremely valuable in specific distinction.

As to classification, the Erysipheæ are at present considered a family of Perisporiaceæ, in the order Pyrenomycetes of the great class Ascomycetes. Thus:—

Class, ASCOMYCETES.
Order, PYRENOMYCETES.
Sub-order PERISPORIACEÆ.
Family ERYSIPHEÆ.

This family also possesses great interest on account of its economic bearings. The mildew of the rose, the hop, the gooseberry, the grape, and the lilac are well known. Injuries to cultivated plants must result from the presence of the parasite upon them. That the mildews are superficial in development is evident from the description just given but the effect upon the host frequently observed, is satisfactorily explained by assuming that the fungus takes from the host plant the materials necessary for its growth and development. How far the presence of the mycelium upon the leaf may interfere with its normal function, cannot be stated.

Being superficial in growth and wholly superficial in the production of the fruiting bodies, the remedy is easily applied and fairly effective. Sulphur has been used successfully in the treatment of rose mildew in the greenhouse and the use of copper compounds as fungicides in spraying is rapidly becoming general. The mixtures recommended by the Experiment Station as remedies for apple scab and anthracnose of raspberries ought to prove efficacious with the Erysipheæ. The strength of the solution to be employed must be carefully determined by experiments upon the particular plant to be sprayed. Good remedies in careless hands may be the cause of as much injury as the fungus itself. On the other hand it may be said that the abandonment of gooseberry growing because the larger English varieties suffer greatly from mildew, is a doubtful expedient. As yet no good reason has come to light why spraying gooseberries for the mildew will not prove as beneficial as spraying apples for scab.

Precautionary measures are always in order: The fruiting bodies of the mildew are left upon the leaves or other parts at the close of the season's growth. The spores of the fungus are liberated only by the decay of the wall of the perithecium, which occurs when the leaves rot in the spring and early summer. Much would certainly be gained by gathering and burning all the leaves of diseased plants soon after they have fallen.

KEY TO THE GENERA OF ERYSIPHEÆ.

A. Appendages similar to the mycelium and interwoven with it:
  1. Only one ascus in each perithecium, *Sphærotheca.*
  2. Several asci in each perithecium, *Erysiphe.*

B. Appendages distinctly different from the mycelium and usually separate from it:
  1. Appendages coiled at the tips, *Uncinula.*
  2. Appendages abruptly swollen at the base, tips straight, *Phyllactinia.*
  3. Appendages dichotomously branched at the tips:
    a. One ascus in each perithecium, *Podosphæra.*
    b. Several asci in each perithecium, *Microsphæra.*

SPHÆROTHECA, Lév.

Perithecium containing only one ascus. Appendages similar to the mycelium and frequently interwoven with it.

SPHÆROTHECA PANNOSA (Wallr.) Lév. Rose Mildew.

On species of *Rosa* both wild and cultivated. Fruit of the fungus scarce. Conidial stage only, collected.

Rosa (cultivated): Athens Co., Sept. 8, Aug. D. Selby; Columbus in greenhouse, January.

SPHÆROTHECA MORS-UVÆ (Schw.) B. & C. Gooseberry Mildew.

No specimens examined. Reported over the state especially on English varieties of gooseberry.

SPHÆROTHECA CASTAGNEI, Lév.

On *Taraxacum officinale*: Columbus, Aug. 20. Freda Detmers. *Bidens frondosa*: Franklin Co.—Georgesville, Sept. 24, Worthington, Oct. 3. Selby. *Erechthites hieracifolia*: Worthington, Oct. 3, Aug. D. Selby and W. C. Werner.

This is the commonest *Sphærotheca* conveniently obtained in fruit. It is reported upon a large number of composites and upon representatives of other orders.

SPHÆROTHECA PHYTOPTOPHILA, Kell. & Swingle. Mildew of the Hackberry Knot.

On *Celtis occidentalis* affected by a Phytoptus. The perithecia are found upon the distorted branchlets. Lima, May, 21, W. A. Kellerman, (no asci or spores), Columbus, Oct. 26, Selby.

The spores are rather late in maturing; the mycelium sparse. It would be very interesting to know how frequently the "knot" occurs without the mildew.

Other species of *Sphærotheca* are likely to be found in the state: *S. pruinosa*, C. & P. on *Rhus*, and *S. Humuli* (DC.) Burrill, on hop and Rosaceous plants are reported in our range, while *S. Mali* (Duby) Burr., a very interesting and somewhat anomalous one, occurring upon twigs of the apple, is reported from the Mississippi Valley. The young trees of the nursery and suckers from old ones are said to be most liable to attacks of the fungus.

ERYSIPHE (Hedw.) Lév.

Appendages as in *Sphærotheca*. Perithecium containing several asci.

ERYSIPHE LIRIODENDRI, Schw.

On *Liriodendron Tulipifera*: Columbus, September and October (conidial stage) Selby; Sugar Grove, Fairfield Co., Oct. 8, Nov. 7, Selby.

This species is reported as fruiting late. The observations made confirm this. The specimens from Sugar Grove are apparently abnormal in the distribution of the dense mycelium bearing the perithecia. The mycelium is in narrow bands as if following the path of a leaf miner within or a larva without. In structure, size and number of asci and spores it answers to the description given.

ERYSIPHE COMMUNIS (Wallr.) Fr.

On *Clematis Virginiana*: Columbus—Weed, Oct. 15, Selby. *Clematis* (cultivated): Columbus, Oct. 15, and Nov. 5, Selby; Waynesville, Warren Co., Oct. 15, Kellerman. *Aquilegia Canadensis*: Gahanna (Columbus) September, Miss Detmers. The conidial stage of a mildew was taken on *Ranunculus* and *Œnothera* Columbus, Oct. 4–15, which is probably to be referred to *E. communis* since it is reported upon both of these hosts.

This species has not as yet been collected here upon *Leguminosæ*. The larger number of spores in each ascus, 4–8, has chiefly been relied upon to distinguish it from the two following.

ERYSIPHE CICHORACEARUM, DC.

On *Eupatorium perfoliatum*: Columbus, Oct. 1, Weed. *Aster Shortii*: Columbus, Oct. 15, Selby. *A. ericoides* var. *villosus*: Columbus, Oct. 15. Selby. *A. prenanthoides*: Amanda, Fairfield Co., Oct. 1, Kellerman; Waynesville, Warren Co., Oct. 15, Kellerman. *A. puniceus*: Columbus, Oct. 4, Selby. *Aster* sp: Columbus, Oct. 15, E. V. Wilcox; Meigs Co., Nov. 7, P. L. Pfarr. *Dahlia* (cultivated): Amanda, Oct. 1, Kellerman; Georgesville, Franklin Co., Sept. 24, Selby. *Ambrosia trifida*:—Georgesville Sept. 24 and Hilliard Sept. 21, Selby; Sugar Grove, Fairfield Co., Oct. 8, Selby; Bainbridge, Ross Co., Oct. 8, Kellerman; Haydenville, Aug. 11, Kellerman; Granville, Licking Co., Sept. 22, H. L. Jones. *A. artemisæfolia*: Waynesville, Oct. 8, Kellerman; Columbus, Sept. 14, Weed, Sept. 16, Selby, Sept. 21, Miss Detmers. *Xanthium Canadense*:—Georgesville, Sept. 24, Selby & Werner. *Helianthus* sp: Columbus, Aug. 13, Sept. 13, Weed, Oct. 7, Richardson; Granville, Sept. 22, Jones. *Helianthus strumosus*: Granville, Sept 22, Jones. *H. decapetalus*: Columbus Sept. 24, Weed. *H. tuberosus*: Columbus, Sept. 18, Selby; Sugar Grove, Oct. 8, Selby; Bainbridge, Oct. 8, Kellerman; Waynesville, Oct. 15, Kellerman. *Actinomeris squarrosa*: Columbus, Sept. 24, Weed; Georgesville, Sept. 24, Selby, *Lactuca leucophæa*: Athens, Aug. 11, Kellerman; Columbus, Oct. 3, 4, 15, Selby. (Conidial stage only on this host.) *Hydrophyllum macrophyllum*: Columbus, May 30, Selby; Nebraska, June 11, Kellerman. *Phlox* (cultivated): Amanda, July 30, Kellerman. *Echinospermum Virginicum*: Ironton, May 27, Werner; Columbus, Oct. 15, Selby, (conidial stage only). *Verbena urticæfolia*: Columbus, Sept. 16, Selby, Oct. 7, Richardson; Sugar Grove, Oct. 8, and Nov. 7, Selby. *V. hastata*: Columbus, Sept. 13, and 14, Weed. *Parietaria Pennsylvanica*: Columbus, Sept. 21, Selby.

This is the most common of all the mildews and occurs upon a large number of hosts, especially among *Compositæ*. The forms on *Hydrophyllum* and *Verbena* are not less abundant. That on the first named being the earliest in this locality to make its appearance out of doors as well as the earliest to mature its spores.

It is distinguished from the preceeding species by the smaller number of spores to an ascus, having almost uniformly two spores in each ascus. No marked deviations from this number have been observed. This character it possesses in common with *E. Galeopsidis* from which it is separated by the rounded haustoria.

ERYSIPHE GALEOPSIDIS, DC.

On *Scutellaria lateriflora*: Franklin Co.—Georgesville Sept. 24, Selby.—Worthington Oct. 3, (3 specimens) Werner; Sugar Grove, Fairfield Co., Oct. 8, Selby. *Stachys aspera* var *glabra*: Columbus, Sept. 24, Kellerman; Georgesville, Sept. 24, Werner. *Stachys cordata*: Georgesville, Sept 24, Selby. *Chelone glabra*: Ashtabula Co., Sara F. Goodrich.

As in the preceding there are two spores to an ascus. It is satisfactorily separated from *E. Cichoracearum* only by its "lobed" haustoria. The host plants serve as a guide. Dr. Winter observes "that it is distinguished from the preceding by the spores only ripening in the following spring. Hence none but sterile asci are found in the perithecia upon the green host plant." This observation is confirmed by the examinations made.

ERYSIPHE GRAMINIS, DC. Wheat Mildew.

On *Agropyrum repens*: Ashtabula Co., June 22, Miss Goodrich. *Poa pretensis*: Columbus, Station greenhouse, March 4, and Scioto river Nov. 19, Kellerman. *Triticum vulgare*: Columbus April 22, Miss Detmers; Lima, May 21, Kellerman.

No perithecia were found on any of the specimens; only the conidial form called *Oidium monilioides*, Link. It is somewhat surprising to find it growing out of doors so late as on one of the specimens. The perithecia and spores are reported as late in developing.

UNCINULA, Lév.

Perithecia containing several asci; appendages coiled at the tips.

UNCINULA NECATOR (Schw.) Burrill. (*U. spiralis*, Berk. *U. Ampelopsidis*, Peck.) Grape Mildew.

On *Vitis* (cultivated): Columbus, July 26, Kellerman; Westerville, Franklin Co., L. H. McFadden; Granville Licking Co., Sept. 21, Herbert L. Jones. *Ampelopsis quinquefolia*: Columbus, Oct. 7, H. H. Richardson, Aug. 27 and Oct. 1, Weed, Sept. 10 and 22, Selby; Granville, Sept. 21, Jones.

Reported generally on both hosts. The forms differ only in the longer appendages of that occurring on *Vitis*.

UNCINULA FLEXUOSA, Peck.

Specimens are all amphigenous. On *Aesculus glabra*: Columbus Aug. 24, Sept. 24, Weed, Aug. 3, F. M, Webster.

This species is easily recognized by the flexuous appendages. It is reported only on *Aesculus*.

UNCINULA CIRCINATA, C. & P.

On *Acer dasycarpum*: Columbus Oct. 14, Weed; Sugar Grove, Fairfield Co., Oct. 8, Selby.

Like the species described from *Scutellaria*, this one has large depressed perithecia, but the asci are numerous and very narrow. The spores are eight in each ascus.

UNCINULA MACROSPORA, Peck.

On *Ulmus Americana*: Fairfield Co.; Amanda, Nov. 10 ('82) Kellerman; Franklin Co.—Columbus, Aug. 13, Weed, Sept. 26, Werner, Oct. 15, Selby, Worthington, Oct. 3, Werner and Selby. *Ulmus fulva*: Columbus, Aug. 13, Weed; Rock Mills, Fairfield Co., Nov. 1, Miss Detmers, Sugar Grove, Oct. 8, Selby; Waynesville, Oct. 8, Kellerman.

UNCINULA SALICIS (DC.). Winter.

On *Salix* sps.: Franklin Co.—Columbus, Oct., Weed and Craig, Oct. 4, E. E. Bogue, Oct. 9, Weed, Oct. 15, Selby, Oct. 17, Kellerman,—Georgesville, Sept. 24, Selby, Worthington, Oct. 3, Selby; Fairfield Co.—Amanda, Oct. 1, Kellerman. *Salix nigra*: Columbus, Sept. 24, Weed.

The very abundant mycelium of this mildew makes it conspicuous. It is found everywhere on willows.

UNCINULA COLUMBIANA, *sp. nov.*

Amphigenous. Mycelium moderately abundant, denser in patches, arachnoid. Perithecia large, usually light colored, scattered, depressed, longer diameter 130—160 *u*, occasionally 180 *u*, about twice the shorter; reticulations evident, small, 10—15 *u*, commonly 10—12 *u*. Appendages very numerous, 50 to 70 or more, hyaline, 130—185 *u* in length, smooth, rarely swollen at the tips, closely and abruptly coiled, arising from near the margin of the upper surface of the perithecium. Asci few, 4 to 6 or more, broadly ovate, pedicellate, 35—45x50—70 *u*, mostly 40x65 *u*; spores mostly 5, about 12x25 *u*. (Pl. III, Fig. 5.)

On *Scutellaria lateriflora*, Columbus, O., Oct. 13, 1892, Selby.

This species resembles *U. circinata*, C. & P., in form of perithecia, but is distinguished from it by the more abundant mycelium, by the broader asci and the fewer and larger spores. Unlike previously reported species of the genus its host is an herb and one commonly affected by an *Erysiphe*. A *Microsphæra* has been reported from the same host by Professor Burrill. The material on hand is mature though rather scanty.

PHYLLACTINIA, Lév.

Perithecium containing several asci. Appendages acicular, acute at the tip, abruptly swollen at the base.

PHYLLACTINIA SUFFULTA (Reb.) Sacc.

On *Chelone glabra*: Columbus, Oct. 3, Selby. *Catalpa bignonioides*: Cedar Hill, Fairfield Co., Oct. 1, and Waynesville, Warren Co., Oct. 15, Kellerman. *Carpinus Caroliniana*: Amanda, Fairfield Co., Oct. 1, Kellerman. *Quercus nigra*: Lancaster, Oct. 28, ('83). Kellerman. *Quercus coccinea* var *tinctoria*: Rock Mills, Fairfield Co., Oct. 1, Miss Detmers. *Castanea sativa* var *Americana*: Gann, Knox Co., Nov. 1, H. J. Detmers. *Fagus ferruginea*: Worthington, Oct. 17, Miss Detmers.

The single species of the genus is reported upon a small number of herbs and not heretofore on *Chelone*.

PODOSPHÆRA, Kunze.

Perithecium containing a single ascus. Appendages free from the mycelium, dichotomously branched at the ends.

PODOSPHÆRA OXYACANTHÆ (DC.). DBy. Mildew of Cherry and Plum.

On *Prunus Cerasus*: Dayton Sept. 9, Jos. Potts; Columbus Sept. 19, Weed, Oct. 7, H. H. Richardson. *Prunus Chicasa*: Columbus, July 26, Miss Detmers.

This seems to be quite frequent in the region represented by the specimens.

MICROSPHÆRA, Lév.

Adpendages as in *Podosphæra* or less branched. Several asci in each perithecium.

Several of the species of this genus are not separable, aside from host plants, except by the branching of the appendages and the character of the ultimate branchlets.

MICROSPHÆRA RAVENELLII, Berk.

On *Gleditschia triacanthos*: Columbus, Oct. '88, Weed and Craig, Sept. 4, Kellerman; Lancaster, Oct. 15, '82, Kellerman; Bainbridge, Ross Co., Oct. 8, and Waynesville, Miami Co., Oct. 15, Kellerman.

The separation of this from the following species depends chiefly upon the short, usually recurved tips of the appendages. The perethecia are about the same size as in *M. diffusa* but the asci are broader.

MICROSPHÆRA DIFFUSA, C. & P.

On *Desmodium canescens*: Columbus, Sept. 13, Weed, Sept. 18, Selby, Sept. 24, Miss Detmers.

Quite well distinguished by the elongated branches and spreading tips of the appendages—not at all recurved.

MICROSPHÆRA GROSSULARIÆ (Wallr.) Lév.

On *Sambucus Canadensis*: Franklin Co.—Columbus, Sept. 26, Kellerman—Worthington, Oct. 3, Selby.

This is well characterized by the erect, obtuse, digitate branchlets of the appendages. It is reported also upon species of *Ribes*.

MICROSPHÆRA VACCINII (Schw.) C. & P.

On *Vaccinium vacillans*: Sugar Grove, Fairfield Co., Oct. 8, Selby; Meigs Co., Nov. 7, P. L. Pfarr. *Gaylussacia resinosa*: Sugar Grove, Oct. 8, Selby.

This species is less difficult to distinguish: the appendages are generally quite long, the tips of the branches less regular, often truncate or bifid.

MICROSPHÆRA ELEVATA, Burrill.

On *Catalpa bignonioides*: Columbus, Oct. 13, Weed.

MICROSPHÆRA ALNI (DC.) Winter.

On *Euonymus atropurpureus*: Bainbridge, Ross Co., Oct. 8, Kellerman; Columbus, Oct. 3, Selby. *Syringa vulgaris*: Columbus, Nov. 6, E. E. Bogue, Sept. 16, and Dec. 10, Selby; Onwell, Ashtabula Co., Aug. 6, Bogue; Sugar Grove, July 18, Athens, Aug. 11, Kellerman. *Platanus occidentalis*: Columbus, Oct. 10, Selby. *Castanea sativa* var *Americana*: Sugar Grove, Sept. 20, Wilcox, Bogue and Weed; Bainbridge, Oct. 8, Kellerman.

Very common on *Syringa*. Only conidial stage found on *Euonymus* and *Platanus*.

However variable the length and divergence of the branches on *M. Alni* these are always symmetrical with the tips acute and distinctly recurved.

MICROSPHÆRA QUERCINA (Schw.) Burrill.

On *Quercus macrocarpa*: Columbus, Aug. 13, Weed. *Q. Prinus*: Columbus, Sept. 19, Weed. *Q. Muhlenbergii*: Columbus, Sept. 24. *Q. rubra*: Columbus, Nov. 7, E. V. Wilcox. *Q. coccinea* var *tinctoria*: Sugar Grove, Fairfield Co., Sept. 20, Wilcox, Bogue and Weed, Oct. 8, Selby; Lawrence Co., Oct. 29, Kellerman.

This interesting species has been reported only upon *Quercus*. The separation of forms of it from *M. Alni*, is made chiefly by reference to the host plants. The forms of *M. quercina* upon the different oaks vary greatly in length of appendages.

ARTICLE XIX.—CORRECTIONS AND ADDITIONS TO MOSES CRAIG'S CATALOGUE OF THE UNCULTIVATED FLOWERING PLANTS GROWING ON THE OHIO STATE UNIVERSITY GROUNDS.

By W. A. Kellerman and Wm. C. Werner, Ohio State University.

The catalogue to which corrections and additions are here offered, was published in Vol. I, No. 2, of this Series, being, as stated in a footnote, a thesis presented to the Faculty of the Ohio State University, June 19, 1889. The work of making the catalogue was chosen in the fall of 1888, hence it is evident, as stated in the introduction, that the time was very short for completing the work, though the author had on hand notes and observations extending over some time previous, This sufficiently accounts for inaccuracies and incompleteness of the catalogue, which it is our purpose to correct and supply, so far as data at present warrant.

The desirability of having a fairly accurate and tolerably complete list of our plants must be evident to all—even if there is no direct interest in this flora, such as the Experiment Station heretofore necessarily had, and the Botanical Department of the Ohio State University still has. This desirability—necessity might perhaps be said—is both the motive and sole object of offering the lists that follow.

I. Corrections in Identifications.

(The numbers prefixed to the species are those of Craig's Catalogue.)

15. *Ranunculus repens*, L. Both the herbarium specimens and the plants of the localities referred to prove to be R. septentrionalis, Poir.

21. *Actaea spicata,* L. The herbarium specimen for the authentication of this species is A. alba Bigel.

30. *Corydalis aurea,* Willd. The plants of the given localities and all the herbarium specimens labeled C. aurea, are C. flavula, DC.

35. *Arabis hirsuta,* Scop. The specimen referred to in the University Herbarium is A. dentata, T. & G.

40. *Camelina sativa,* Crantz. Mr. Aug. D. Selby has one of the specimens referred to, authenticating this species; it is Silene antirrhina.

56. *Viola rotundifolia,* Mx. The specimen in the University Herbarium upon which this name is based, collected by Mr. Green, and labeled V. rotundifolia, is V. pubescens, Ait.

65. *Cerastium viscosum,* L. The Cerastium of the places mentioned is C. nutans, Raf., as is also a specimen in the Experiment Station Herbarium, labeled C. viscosum.

66. *C. arvense,* L., is C. vulgatum, L.

69. *Claytonia Caroliniana,* Mx. The specimens to authenticate this species are broad-leaved C. Virginica, L.

89. *Vitis rotundifolia,* Mx. The specimens prove to be V. riparia Mx.

112. *Desmodium viridiflorum,* Beck. Specimens in the University and Experiment Station Herbariums are D. canescens, and it is quite common on the island.

152. *Circaea alpina,* L. should be referred to C. Lutetiana, L., as is shown by the herbarium specimens and an examination of the plants in the locality named.

158. *Thaspium aureum,* Nutt. The specimens, both in the Experiment Station and University Herbariums, to represent this species, are T. barbinode, Nutt. The dates given, from May 13th to June 3d, are too early for T. aureum, which is a summer-blooming plant, usually not coming into flower until the end of June, and continuing in bloom through July.

175. *Vernonia Noveboracensis,* Willd. should read V. altissima, Nutt. The former (V. Noveboracensis) has not been observed on the grounds nor in Franklin county.

187. *Aster longifolius,* Lam. Mr. Craig had a specimen in his herbarium for authentication of this species; it was a small form of A. Tradescantii, L.

188. *Aster Novi-Belgii,* L. Specimens for verification of this, in the Experiment Station Herbarium, collected by Mr. Craig, and labeled A. Novi-Belgii, are A. puniceus, L.

191. *Erigeron bellidifolius,* Muhl. This plant would hardly grow in such a place as the wet ground near the lake swamp. E. Philadelphicum is quite abundant there, and owing to differences in the character of the ground, is quite variable in size and general appearance. It is undoubtedly the latter species that was collected. There are no authentic specimens, but we have no hesitancy in making this correction.

208. *Helianthus lactiflorus*, Pers. H. tuberosus, L. is very common near the river, but is not given in the list. Specimens in the University Herbarium labeled H. lactiflorus are H. tuberosus. None of the other species of Helianthus quoted in the list, except H. decapetalus, have been found by us.

233. *Hieracium scabrum*, Mx. A specimen of Crepis biennis (labeled Hieracium scabrum), was found in the Experiment Station Herbarium. It was collected on the University grounds, and may be the plant referred to. H. scabrum was not inserted in Selby & Craig's list of Franklin county plants, published later.

241. *Lactuca hirsuta*, Muhl. There is a specimen in the University Herbarium to authenticate this species; it is a top of L. Floridana, Gaert.

275. *Cuscuta glomerata*, Choisy. Mr. Craig had a specimen in his herbarium which represented the C. glomerata of the catalogue. It was C. Gronovii, Willd.

278. *Physalis Philadelphica*, Lam., should read P. lanceolata, Mx.

289. *Ilysanthes riparia*, Raf. The specimen to authenticate this was some other plant, but the species is not now remembered, the name not having been recorded at the time the above error was determined.

310. *Mentha arvensis*, L. Mr. Craig had a specimen of this plant in his herbarium; specimens are also in the University Herbarium. They are a form of Mentha Canadensis.

314. *Monarda fistulosa*, L. Both the plants of the localities named and the herbarium specimens are M. clinopodia, L.

NOTE. *Sassafras officinale*, Nees The tree noted was blown down during a wind storm in the fall of 1891. The species is, however, quite abundant along the Big Darby, near Georgesville.

364. *Urtica dioica*, L. This nettle is U. gracilis, Mx.

375. *Carya porcina*, Nutt. The tree referred to is C. amara, Nutt. There is a large tree of this hickory directly in front of the entrance to the Main Building, also several smaller ones along the northern portion of the woods. Three trees were standing in the pasture near the large bend in the brook, E.2½, E. 3½. One of them was cut down the past year.

381. *Quercus prinoides*, Willd. The tree spoken of (near the Station Building) is Q. Muhlenbergii, Engelm. There are several other specimens of this species on the University grounds. We have seen no Ohio specimens of Q. prinoides.

392. *Ceratophyllum demersum*, L. This plant was not seen while searching for the Myriophyllums referred to later (Doubtful Identifications, Nos. 143–4). After seeing an authentic specimen of C. demersum, Mr. Craig said the plant he referred to as this species was something else.

429. *Cyperus dentatus*, Torr. Specimens of Mr. Craig's collecting, representing this plant, placed in the Experiment Station Herbarium, and labeled C. dentatus, are C. esculentus, L.

431. *Scirpus planifolius*, Muhl. It is impossible to say just which Sedge was intended, since several species not in the catalogue are abundant in the locality given. S. planifolius would hardly be found growing in such a place.

453. *Chrysopogon nutans*, Benth. A specimen in Mr. Craig's herbarium to authenticate this species, proves to be Andropogon scoparius, Mx.

464. *Bromus secalinus*, L. The Bromus referred to as common along the river, is not B. secalinus, but B. ciliatus L. The specimen of B. ciliatus, in the Experiment Station Herbarium, was labeled B. secaliuns, L. The latter species occurs here and there on the cultivated portions of the University grounds.

II. Doubtful Identifications.

4. *Anemone nemorosa*, L. Nothing has been found by us to represent this species, but the var. *quinquefolia*, Gr. Dr. Britton, as a result of his study of this species, has decided that we do not have the true A. nemorosa, L., in America—the *A. quinquefolia* only occuring here.

13. *Ranunculus fascicularis*, Muhl. A thorough search for this plant reveals only forms of R. septentrionalis, Poir. The plant in question may be R. hispidus, Mx.

41. *Nasturtium officinale*, R. Br. This plant is always found in running or fresh water, never in water that is standing or stagnant as is that in the swamp near the river. The specimens labeled Nasturtium officinale in the University Herbarium are Cardamine hirsuta.

143. *Myriophyllum spicatum* L. and 144. *M. heterophyllum* Mx.
A thorough but unsuccessful search was made for these two plants in the the localities named, the same season that the list was published.

359. *Ulmus racemosa*, Thomas. This tree can not be found in the locality named but Ulmus Americana grows along the entire river front.

III. Cultivated Species to be stricken out of the Catalogue, since they do not belong to the Uncultivated Flora.

85. *Ailanthus glandulosus*, Desf. Trees planted.

121. *Prunus Persica*, L.

122. *Prunus Cerasus*, L.

139. *Amelanchier Canadensis* T. & G. This like the preceding should be stricken out. It was brought to the place and planted for ornament.

142. *Liquidambar Styraciflua*, L. The tree west of the Main University Building was planted there and cannot be considered a part of the

uncultivated flora. Nothing of the kind could be found near the river in the locality named. It was left out of the flora of this county by Selby & Craig published subsequent to Craig's catalogue

166. *Cornus florida* L. Planted.
300. *Catalpa bignonioides*, Walt. Planted.
390. *Populus dilatata*, L. Planted.

IV. Species omitted from Selby and Craig's List of Franklin County Plants.

114. *Desmodium rigidum*, DC.
127. *Rubus cuneifolius*, Ph.
206. *Rudbeckia speciosa*, Wender.
212. *Helianthus tracheliifolius*, Willd.
328. *Stachys aspera*, *Mx.* var. *glabra*, Gr.

We do not know the history of these and have seen none of the plants. Had they been correctly reported originally they doubtless would have been inserted in the list referred to, published by Selby and Craig a short time after.

V. Additional Species.

12a. *Ranunculus sceleratus*, L. Cursed Crowfoot.
In a ditch near west line fence of the University farm. W. 3 and 4. S. 5. June, 1891.*

VII*a*. Capparidaceæ.

53a. *Polanisia graveolens*, Raf.
Near Chemical Labratory, Aug. 5, 1890, Aug. 1892. East side of Neil avenue near the brook, Sept. 1891. The last locality is now obliterated.

62a. *Silene noctiflora*, L. Night-flowering Catchfly.
Near the farm house on Woodward avenue, July 30, 1891.

75a. *Hibiscus Trionum*, L. Bladder Ketmia. Flower-of-an-hour.
In the vineyard and quince orchard. South of station building, Aug. 2, 1892. Noticed also at other places on the farm and campus.

145a. *Rotala ramosoir*, Koehne.
Fields back of North Dormitory. W. 3 and 4. S. 4. Aug. 5, 1890.

155a. *Angelica atropurpurea* L.
On the island N. 1½, W. 4½. First observed during the summer of 1891.

---

*The dates in this list indicates only the first collecting of the species after the publication of the catalogue.

159a. *Cryptotænia Canadensis*, DC. Honewort.
Quite common near the river, also found on bank south of the Botanical Building, July 31, 1890. Occasionally met with in the woods.

171a. *Galium trifidum* L. Small Bedstraw. Cleavers.
Hillside south of Botanical Building, Aug. 4, 1890.

173a. *Cephalanthus occidentalis*, L. Button Bush.
East margin of lagoon. W. 4½, S. ½, Aug. 1890.

184a. *Aster sagittifolius*, Willd.
Abundant all along the river. It must have been confounded with A. cordifolius, L., Aug. 5, 1890.

215a. *Bidens connata*, Muhl. Swamp Beggar-ticks.
Edge of the brook, north of Neil avenue, Aug. 1891.

231a. *Centaurea Jacea*, L.
East of Mechanical Labratory, S. 1, E. ⅞.

250a. *Samolus Valerandi*, L. var. *Americana*, Gray. Water Pimpernel. Brook weed.
Margin of the brook west of Neil avenue to bottom land back of North Dormitory, Aug. 5, 1890.

256a. *Asclepias tuberosa*, L. Butterfly-Weed. Pleurisy-root.
Hillside south of Botanical Building, Aug. 1890.

288a. *Mimulus alatus*, Ait. Monkey flower.
Found along the river with M. ringens and equally abundant, Aug. 1890.

288b. *Gratiola Virginiana*, L. Hedge Hyssop.
Found along the brook and river also in the low ground bordering the lagoons.

312a. *Lycopus Virginicus* L. Bugle-weed. Margin of brook near High street, Aug., 1891,

309a. *Mentha viridis*, L. Spearmint. Just south of fence dividing the pasture from the lot of farm house on Woodward avenue. S. 3¾, E. 3⅔. June, 1891.

335a. *Amarantus blitoides*, Watson. Amaranth. In the pasture between the campus and High street. Aug. 1, 1890.

335b. *Acnida cannabina*, L. Water-Hemp. Fields back of North Dormitory.

336a. *Chenopodium Boscianum*, Moq. Pigweed. Back of Electrical Building. Aug., 1890.

343a. *Polygonum Pennsylvanicum*, L. Knotweed. Very common in cultivated ground. Aug., 1890.

343b. *Polygonum Muhlenbergii*, Watson. Knotweed. Only a few were found in the low ground near the western boundary, Aug., 1890.

343c. *Polygonum Persicaria*, L. Lady's Thumb. Abundant in cultivated ground. Aug., 1890.

347a. *Polygonum sagittatum*, L. Arrow-leaved Tear-Thumb. Margin of brook opposite Prof. Knight's house. Aug. 22, 1800.

(Specimens were collected of quite a number of *Willows* growing around the river and lagoons. They have not yet been critically studied).

394a. *Vallisneria spiralis*, L. Tape-grass, Eel-grass. Quite abundant in the lagoons near the river. Aug. 23, 1890,

403a. *Smilacina stellata*, Desf. False Solomon's Seal. Near the edge of the black mucky soil back of the north Dormitory. May, 1891.

411a. *Juncus nodosus*, L. var. *megacephalus*, Torr, Rush. Margin of lagoon near river. Aug. 23, 1891.

428a. *Potamogeton natans*, L. Pond weed. In lagoons near river. Aug. 9, 1890.

428b. *Potamogeton pectinatus*, L. Pond weed. In lagoons near river. Aug. 9, 1890.

428c. *Cyperus diandrus*, Torr. Borders of brook between Neil avenue and the river. July 31, 1890. Also along margin of lagoon near the river.

428d. *Cyperus aristatus*, Rottb. Borders of brook west of Neil avenue. July 31, 1890. Borders of lagoon near river. Aug. and Sept., 1891.

428e. *Cyperus erythrorhizos*, Muhl. Field back of North Dormitory, rare. Aug. 23, 1890.

430a. *Cyperus strigosus*, L. July 31, 1890. }
430b. *Cyperus speciosus*, Vahl. Aug, 2, 1890. }
Both these species are found along the brook between Neil avenue and the river, also in the fields back of the Veterinary Hospital and Dormitory. The C. esculentus of the catalogue must refer to one or both of these plants since that species was referred to as C. dentatus.

430c. *Kyllingia pumila*, Mx. Margin of lagoon near river. Oct., 1891.

430d. *Eleocharis ovata*, R. Br. Margin of brook near river, Aug. 2, 1890, and edge of lagoon, Aug. 9, 1890.

430e. *Eleocharis intermedia*, Schultes. Edge of lagoon near river. Aug. 9, 1890.

430f. *Scirpus pungens*, Vahl. Margin of river. July 31, 1890. Also common in the lagoons.

430g. *Scirpus lacustris*, L. Growing with Scirpus pungens.

530h. *Scirpus fluviatilis*, Gray. (?). There is a Scirpus growing in the lagoons which is undoubtedly this species though no infloresence has been observed. Aug., 1890.

445a. *Carex grisea*, Wahl. Near the river. May, 1891.

445b. *Carex laxiflora*, Lam. var. *latifolia*, Boot. In the clump of timber at the north end of the lagoons. June, 1891.

445c. *Carex pubescens*, Muhl. Rather abundant in the woods. Aug., 1890.

445d. *Carex Shortiana*, Dewey. Plentiful in the woods and various other places. It is the most common Carex in the low ground at the west extremity of the lake. June, 1891.

445e. *Carex stenolepis*, Torr. This is the most common Carex along the brook between High street and Neil avenue. It is occasionally met with in the woods and other damp localities. Aug. 2, 1890.

445f. *Carex stipata*, Muhl. Frequent along the the line of the brook, in the woods and along the river. Aug., 1890.

445g. *Carex stricta*, Lam. Low land adjoining the lagoons. June, 1891.

445h. *Carex tentaculata*, Muhl. In the woods and timber belt along the river and lagoons. Aug., 1890. Several of the Carices given in the catalogue have not as yet been found by us.

446a. *Panicum glabrum*, Gaudin. }
446b. *Panicum proliferum*, Lam. }
July 31, 1890. These two grasses were found to be most troublesome weeds in the lawn near the Botanical Building, especially the first which formed large unsightly mats. Both are frequently met with on the campus and in the pastures.

452a. *Leersia Virginica*, Willd. First observed in a bed of ferns near the Botanical Building, Aug. 9, 1890. Rather common in the woods, occasional másses of it have been found along the line of the brook.

455a. *Muhlenbergia Mexicana*, Trin. Common along the brook and river and land bordering the lagoons. Aug. 1, 1890.

455b. *Alopecurus geniculatus*, L., var. *aristulatus*, Torr. Margin of the brook south of the Botanical Building. June, 1891.

456a. *Sporobolus vaginæflorus*, Vasey. Frequent in portions of the pasture near High street and on the campus, especially around the Main Building and Chemical Laboratory.

457a. *Agrostis alba*, L. Common. June, 1891.

457b. *Cinna arundinacea*, L. Common along the river and around the lagoons. Aug., 1890.

459a. *Eragrostis reptans*, Nees. Margin of brook and borders of lagoon. July 31, 1890.

459b. *Eragrostis Frankii*. Meyer. Fields in the bottom lands back of the north Dormitory. Aug. 5, 1890.

459c. *Eragrostis Purshii*, Schrader. Dry places and along paths and drives on the campus. July 31, 1890.

459d. *Eragrostis capillaris*, Nees. Fields back of Veterinary Hospital Aug. 5, 1890.

461a. *Poa annua*, L. Door yard of farm house on Woodward avenue. July, 1891.

462a. *Glyceria nervata*, Trin. Common in the woods. Aug. 9, 1880.

463a. *Festuca nutans*, Willd. Found in the timber north of the lagoon. June, 1891.

464a. *Bromus racemosus*, L. Frequent on the farm. June, 1891.

467a. *Elymus Canadensis*, L. This species is very abundant near the river, rather more so than E. Virginicus. Aug., 1890.

467b. *Elymus striatus*, Willd. Aug., 1890. A single plant found.

The FERNS are not included in Mr. Craig's cataloge. Of this group we have found in the woods three species, namely:

Cystoperis fragilis, Bladder fern.
Botrychium ternatum obliquum, Grape fern.
Botrychium ternatum dissectum, Grape fern.

ARTICLE XX—NOTES ON DISTRIBUTION OF AND STATIONS FOR A FEW RARE AND INTERESTING OHIO PLANTS.

By WM. C. WERNER, Ohio State Univerity.

RANUNCULUS FASCICULARIS, MUHL.

The only specimens that have come to my notice are from; Toledo, J. A. Sanford; Springfield, Mrs. E. J. Spence; Georgesville, Franklin Co., Aug. D. Selby.

ARABIS PATENS, SULLIV.

Rocky banks of the Scioto, near Columbus.

This Sullivants original locality, is still so far as we know by specimens the only one in Ohio. Rediscovered a few years ago by Aug. D. Selby.

NAPÆA DIOICA, L.

Sugar Grove, Fairfield Co., E. V. Wilcox; Springfield, Mrs. E. J. Spence.

SULLIVANTIA OHIONIS, TORR. & GRAY.

So far as I know this plant has not been collected in Ohio since its first discovery in Highland Co. by Mr. W. S. Sullivant.

The past season it was found by Prof. Kellerman near the Rock House in Hocking Co, and at Mineral Springs, Adams Co.

I collected it at Fultonham, Muskingum Co.

Both of Prof. Kellerman's localities are of sandstone formation that of Fultonham is sub-carboniferous limestone.

LIQUIDAMBAR STYRACIFLUA, L.

Otway, Scioto Co., W. A. Kellerman.

CORNUS CANADENSIS, L.

In the Beardslee catalogue this species is given for Summit Co., Dr. Newberry as authority. And for for Painesville, Miss Prescott.

Miss Prescott found only a few specimens.

In 1880 Dr. L. B. Tuckerman met with it near Morgan, Ashtabula Co.

While botanizing east of Painesville during the spring of 1885 I found a patch of these plants about a rod square. This station is about obliterated.

Mr. H. L. Jones in his catalogue of the plants of Licking Co. notes its rare occurrence in one locality. From the fact that it has been observed in central Indiana we may hope to find it in rich wooded sections across the state.

SOLIDAGO OHIOENSIS, RIDDELL.

This species was described by Dr. Riddell in 1835, the localities given were, "Cleve's praire' Dayton, and two miles south from Columbus."

Last autum Mr. E. M. Wilcox, rediscovered it along the canal near the southern out-skirits of the city. This may be Riddells Columbus Station for this species. The past autum I found it in the Cedar swamps, in the southern part of Champaign Co.

An effort will be made next summer to find out whether it still exists in the Dayton locality.

SOLIADGO RIDDELLII, FRANK.

Peat bogs near Gypsum, Ottawa Co., W. Krebs; Springfield, Mrs. E. J. Spence.

South of Columbus growing with S. Ohioensis, Werner. A search will be made for this plant in the original localities given by Dr. Riddell viz: Scott's plains, 12 miles E. from Worthington, Franklin Co., Hoffman's Prairie 8 miles E. from Dayton.

HELIANTHUS OCCIDENTALIS, RIDDELL.,

Georgesville Franklin Co., Werner.

I cannot say if the plant still exists near Dover, Tuscarawas Co., the region where Riddell first found it.

PLANTAGO MAJOR, L.

This plant appears to be rare in Ohio. I have found it sparingly at Painesville for the past twelve years, and the past season, along the roadside near Cedar swamps Champaign Co. No specimens from any other locality have been seen.

PHORADENDRON FLAVESCENS NUTT.,

Mathew McCleary, Ava, Noble Co.,
Southern Scioto Co., W. A. Kellerman.
Lawrence Co. along the Ohio river, Werner.

At the meeting of the University biological club held Sept. 20, 1892 stations for this plant were reported as follows: 10 miles southeast of Batavia, Clermont Co., H. A. Surface; Athens Co., Aug. D. Selby; Morgan Co., 3 miles north of Athens Co. line, C. B. Morrey.

QUERCUS NIGRA, L.

Lawrence Co., W. A. Kellerman.
The only locality from which specimens are at hand.

QUERCUS IMBRICARIA × COCCINEA (Q. LEANA, NUTT).

Preston, Hamilton Co., one tree, reported by Prof. A. P. Morgan; Cincinnati, one tree reported by Joseph F. James; Brownsville, Licking Co., one tree, since cut down, W. A. Kellerman.

THUYA OCCIDENTALIS, I.

"Falls of the Little Miama", Daniel Drake in picture of Cincinnati. p. 83.

Ross Co., W. A. Kellerman.

Banks of the Scioto river north west of Columbus, and Cedar swamps south of Urbana, Werner. In the latter place I found trees ranging from fifty to ninety feet in height and over two feet in diameter. A sawmill has been in operation for quite a number of years cutting the timber into boards.

Riddell notes Cupressus thyoides L. for the "rocky banks of the Scioto river". Sullivant gives it for Franklin Co., Dr. Newberry's catalogue quotes this species for eastern and southern Ohio. The Beardslee catalogue gives it for Urbana swamps, Sullivant as authority. Since the Thuya was found in two of the localities given it may perhaps be correctly assumed that the Chamæcyparis thyoides (L.) B. L. P. (Cupressus thyoides) does not after all come within our range.

IRIS CRISTATA, AIT.

This species is comparitively new to our lists of Ohio plants. It was first brought to light by Mr. R. H. Ingraham, Trumbull Co. Although Mr. Aug. D. Selby had seen it in the hills of Lawrence Co. several years before. Mr. Wm. Krebs has sent in specimas from near Cleveland. The past season I found it near Georgesville, Franklin Co. Prof. Wright gives it in his catalogue of Lorain Co. plants.

POLYPODIUN INCANUM, SWARTZ.

Adams Co., W. A. Kellerman.

ASPLENIUM PINNATIFIDUM, NUTT.

Fairfield Co., E. V. Wilcox; Lawrence Co., Werner.

ARTICLE XXI.—NEW PLANTS FOR THE FLORA OF OHIO.

BY WM. C. WERNER, Ohio State University.

When no authority is given the writer is responsible for the locality.

In the compilation of this list, only such species have been included as have not heretofore been noted for Ohio in any of the state catalogues of Ohio plants.

Quite a number of adventive or naturalized plants are admitted, most of which are of recent introduction, while several have been observed for years. All the species given are represented by herbarium specimens.

Aconitum Noveboracense, Gray.

Cuyahoga Falls, Summit Co., W. Krebs, 1890.

A. Uncinatum L. was given for the same locality in Dr. Beardslee's catalogue of the plants of Ohio. Prof. E. W. Claypole of Akron tells me he has seen only A. Noveboracense in that locality.

Ranunculus arvensis, L.

Painesville, Lake Co. First observed in 1888.

Ranunculus Ficaria, L.

Painesville, Lake Co., Otto Hacker, 1892.

Cardamine arenicola, Britton.

Geneva, Ashtabula Co., Miss S. F. Goodrich, 1882. Specimen identified by Dr. Britton.

Thlaspi arvense, L.

Toledo, J. A. Sanford, 1878. A single specimen in the Univerity herbarium.

Lechea racemulosa, Michx.

Fairfield Co., 1890. Adams Co., W. A. Kellerman, 1892.

Claytonia perfoliata, Donn.

Painesville, Otto Hacker, observed nearly every season since 1886.

Stellaria graminea, L.

Near Cleveland, Wm. Krebs, 1890.

Lychnis vespertina, Sibth.

Cleveland, Wm. Krebs, 1891. Painesville, Otto Hacker, 1892.

Ascyrum Crux-Andreae, L.

Sugar Grove, Fairfield Co., E. V. Wilcox, 1890. Lawrence Co., 1892.

Hypericum Canadense, L., *var. majus*, Gray.

Gypsum, Ottawa Co., Wm. Krebs, 1890.

Hypericum petiolation, Walt. (*Elodes petiolata*, Pursh).

Painesville, Lake Co., First collected in 1885.

Geranium columbinum, L.

Painesville, Otto Hacker, 1892.

Geranium dissectum, L.

Painesville, Otto Hacker, 1892.

Oxalis cornicutata, L.

Painesville, Otto Hacker, 1892; Monroe Co., H. Herzer, 1892; Rio Grande, Gallia Co., W. W. Deckard, 1892.

Meibomia obtusa (Muhl.), A. M. Vail. (*Desmodium ciliare*, DC.)

Summit Co., Wm. Krebs, 1890; Georgesville, Franklin Co., 1892.

Ribes nigrum, L.

Lake Shore near Cleveland, Wm. Krebs, 1890; Fields near Painesville, Otto Hacker, 1892.

Myriophyllum heterophyllum, Michx.

Geneva, Miss S. F. Goodrich.

Opuntia Rafinesquii, Englm.

Cedar Point Ottawa Co., Wm. Krebs.

Cornus asperifolia, Michx.

Toledo, J. A. Sanford, 1878: Springfield, Mrs. E. J. Spence, 1878; Georgesville, Franklin Co., Aug. D. Selby, 1891.

Viburnum nudum, L. var. *cassinoides* (L.), Jacq.

Painesville, 1889; Ashtabula Co., E. E. Bogue, 1890.

Symphoricarpus racemosus, Michx. *var. pauciflorus*, Robbins.

Cedar Point, Ottowa Co., W. Krebs, 1890.

Lonicera japonica, Thunb.

There is a dense growth of this Honeysuckle on an embankment of the C. H. & D. R. R. about two miles south of Ironton, Lawrence Co., 1892.

Lonicera oblongifolia, Muhl.

Lake shore near Cleveland, W. Krebs, 1890.

Lonicera xylosteum, L.

Painesville, Otto Hacker, 1891. This shrub is frequently found in fence corners and thickets in the vicinity of a nursery. The seeds having become widely scattered through the agency of birds.

Galium verum, L.

Painesville, Otto Hacker, 1888.

Aster viminuus, L

Cleveland, E. Claassen, 1891.

Eupatorium serotinum, Michx.

On grounds of Sells Brothers' circus Columbus, E. M. Wilcox, 1891.

Liatris cylindracea, Michx.

Georgesville, Franklin Co., Aug. D. Selby, 1890.

Senecio viscosus, L.

Painesville, Otto Hacker, 1892.

Centaurea Jacea, L.

Richland Co., E. Wilkinson, 1892.

Lobelia puberula, L.

Rio Grande, Gallia Co., J. W. Davis, 1892.

Hottonia inflata, Ell.

South New Lyme, Ashtabula Co., Miss F. S. Tuckerman.

Erythraea Centaurium, Pers.

Painesville, J. Wetzel.

Heliotropium anchusæfolium, Poir.

Spontaneous in a nursery where it has been observed since 1872.

Mentha aquatica L. *var. citrata*, (*M. citrata*, Ehrh).

Columbus, E. M. Wilcox, 1892.

Pycnanthemum muticum (Michx.), Pers. *var. pilosum*, Gr.

Dover Bay, Cuyahoga Co., E. Claasen, 1890. Springfield, Mrs. E. J. Spence.

Bignonia capreolata, L.

Ironton and Hanging Rock, Lawrence Co.. 1892; Abundant in Symmes Creek Valley Lawrence Co., W. A. Kellerman, 1892.

Chenopodium glaucum, L.

Toledo, J. A. Sanford, 1878.

Polygonum Hartwrightii, Gray.

Springfield, Mrs. E. J. Spence.

Habenaria peramœna, Gray.

Sugar Grove, Fairfield Co., E. V. Wilcox, 1891; Rio Grande, Gallia Co., Lizzie Davis, 1892.

Eleocharis quadrangulata, R. Br.

Summit Co., E. Classen, 1890.

Scirpus sylvaticus, L.

Richland Co., E. Wilkinson, 1892.

Carex lupulina, Muhl, *var. pedunculata*, Dewey.

Painesville and Licking reservior, 1891.

Carex communis, Bailey. *var. Wheeleri*, Bailey.

Sugar Grove, Fairfield Co., 1891.

Bromus purgans, L.

Painesville, 1879. Franklin Co., 1891.

Eatonia Dudleyii, Vasey.

Painesville, 1879; Fairfield and Franklin counties, 1891; Marion Co., W. D. Whipps, 1892. This seems to be the common Eatonia of Ohio, I have thus far found E. Pennsylvanica only at Painesville.

Buxbaumia aphylla, L.

Painesville, 1876.

Fosombronia cristata, Lindb.

Rendville, Perry Co., 1891. Identified by Prof. L. M. Underwood.

ARTICLE XXII.—NOTES ON RARE OHIO PLANTS.

BY AUG. D. SELBY.

As a brief contribution toward the improvement of our knowledge of plant distribution in Ohio, the following notes are offered on the three species placed before the Academy.

ERYSIMUM ASPERUM, DC. A crucifer called Western Wall-flower appears to be infrequently met with in the state. It occurs at intervals along the limestone exposures of the Scioto river near Columbus; its occurrence might be expected over two-fifths of the state.

SILENE ROTUNDIFOLIA, Nutt. A peculiar and rather rare species, occurs in abundance at Ash Cave, Hocking county. A number of specimens were taken in August 1889. The favorite habitat is the secluded moist, shaded and sand-covered ledges of the friable sandstones.

GONOLOBUS OBLIQUUS, R. Br. One of the twining Milkweeds, (whose general distribution is coast-wise or south Appalachian) has been collected frequently by the writer along the banks of the Scioto north of Columbus. Mr. J. S. Hine has taken it by the Big Darby near Georgesville (Franklin county). It doubtless occurs in many other localities in the state. The flowers are reported fragrant, they certainly have an odor.

ARTICLE XXIII.—NEW OR RARE PLANTS OF OHIO.

BY W. A. KELLERMAN.

A beautiful specimen of the American Holly (*Ilex opaca*) twenty-eight feet high and twenty-eight inches in circumference at the base, was found the past season in the south eastern portion of Lawrence county. The tree was near a log cabin but the evidence collected seemed to establish conclusively the fact that it was a native. No others were found in the neighborhood. Though south of the Ohio river the species is abundant. This may then perhaps be properly added to the list of native Ohio plants.

A fine specimen of Lea's Oak (*Quercus Leana*) was found early in the winter in the southeast corner of Licking county. It has since been cut down. It was in a small grove with Black and Laurel oaks. In character of leaves and fruit it strongly approaches Quercus imbricaria; indeed it could easily be considered a *variety* of the latter. The only other trees of this rare oak so far as reported in the state are in or near Cincinnati.

A form of the Pitch Pine, which has been designated as *Pinus rigida* var. *lutea*, Kellerman, and described before the A. A. A. S. Rochester meeting, August 1892 (See Botanical Gazette XVII, 280) was found sparingly with the species in the southern portion of Fairfield county.